

# ***WESTRALIAN FOUNDERS OF TWENTIETH CENTURY MINING***

**CAREER BIOGRAPHIES  
OF MINING ENGINEERS, MINE MANAGERS AND  
METALLURGISTS WHO WORKED  
IN THE WESTERN AUSTRALIAN MINING INDUSTRY  
1890–1920**

**Compiled by**

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This digital .pdf version has been prepared by Engineering Heritage Western Australia from a CD made available by Mrs Pat Hartley which contained the original pre-print .doc files. The plans at pages xv to xx have been added as scans from a printed version. This digital version has been reformatted to A4. This has reduced the section on career Biographies from 179 to 159 pages. Accordingly, the 'starting page of each entry' on pages vi to viii have changed, but have not been updated. Other than this formatting change, the digital version is an accurate copy of the printed version.

Mike Taylor  
Secretary EHWA  
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### ***Dedication***

This book is dedicated to the memory of Denis A. Cumming (1923-1995). Denis was one of the leading authorities on Australian engineering and mining heritage and on the history of the engineering profession in Australia. He was the instigator of this collaborative book of biographies of mining technologists of the Golden Era but died suddenly while the book was still being compiled. His fellow author hopes that this long-awaited volume attains the same level of accuracy and proportion found in all Denis's work.



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## BIBLIOGRAPHIC REFERENCES (i)

- ADB *Australian Dictionary of Biography*, 12 vols, MUP, 1966-90
- Alexander Alexander, F.A., *Campus at Crawley*, Nedlands, 1963
- AMER *Australian Mining & Engineering Review* (1908-1910)
- AMS *Australian Mining Standard* (pre 1900-1914)
- ArcEA Archives, Institution of Engineers, Australia, Canberra
- ArcAusMM Archives, Australasian Institute of Mining and Metallurgy, Melbourne
- ASMS *Australian Statesman & Mining Standard* (1914-1917)
- Battye Battye, J.S., *The Cyclopaedia of Western Australia*, 1912, 2 vols
- BB Blue Book (date)
- BDWA Erickson, R. (comp.), *The Bicentennial Dictionary of W.. A.. 1829-1988*, 4 v., 1988
- BGSWA *Bulletin of the Geological Survey of Western Australia*
- BLPA Battye Library Private Archives
- Birrell 4 Birrell, R.W., *Monograph 4: The Zebina Lanes, father and son*, Victoria, 2000
- Birrell 7 Birrell, R.W., *Monograph 7: Minerals Separation Ltd & the Flotation Process*, 2000
- Black /Bolton *Biographical Register Members of Parliament of WA*, 2 v., (1870-30, 1930-2004)
- Blainey Blainey, G., *The Rush that never ended*, Melbourne, 1969 (2<sup>nd</sup> ed.)
- Blainey Lyell Blainey, G., *The Peaks of Lyell*, Melbourne, 1967 (3<sup>rd</sup> ed.)
- Blainey Gn Mile Blainey, G., *The Golden Mile*, St Leonards, NSW, 1993
- Bridge Bridge, P. et al., *John Dunn and the Wealth of Nations*, Carlisle, 2010
- Bull Bull, M., *White Feather: The Story of Kanowna*, Carlisle, 1987
- CAPP Commonwealth of Australia, Parliamentary Papers
- CEMR *Chemical Engineering & Mining Review* (1917-1957)
- Chappell Chappell, P., 'Fortune & failure' in Layman & Fitzgerald, *110 degrees*, Perth, 2012
- Charleton Charleton, A.G., *Gold Mining and Milling in Western Australia*, 1903
- Chase/Krantz Chase, D. & Krantz, V., *Mt Morgans: the story of a gold mining town*, Perth, 2002
- CIMR *Commerce-Industrial and Mining Review* (1954-1958)
- Clark Clark, D., *Australian Mining & Metallurgy*, 1904
- Cleland Cleland, E.D., *West Australian Mining Practice*, 1911
- CM *Coolgardie Miner*
- CMWA Report of the Chamber of Mines of Western Australia
- Colebach Colebatch, Sir Hal, *Story of a hundred years of Western Australia 1829-1929*
- Colless *Men of Western Australia*, Colless, Perth, 1937
- Davies Davies, M., 'Metropole & Periphery: City Finance & de Bernales', UWA June 1996
- de Havelland de Havelland, D.W., *Gold & Ghosts: a prospector's guide* (2 vols), Carlisle, 1985
- Dew Dew, J.M. (comp.), *Mining People: A Century*, AusIMM, 1993
- DM(P) Western Australian Department of Mines (and Petroleum)
- DWAE Erickson, R. (comp.) *Dictionary of Western Australia*, 1979, vols 2-5
- DWAS Statham, P., (comp.) *Dictionary of Western Australia*, 1979, vol. 1
- E&MJ *Engineering and Mining Journal* (USA)
- EGHS Eastern Goldfields Historical Society
- Eissler Eissler, M., *Metallurgy of Gold*, 1900 (5<sup>th</sup> ed.)
- Ewers Ewers, J.K., *The Western Gateway, a history of Fremantle*, Nedlands, 1971
- FJA *Fred Jones Annual* (date)
- Glover/Bevan Glover, J. & Bevan, J., *Forgotten Explorers: pioneer geologists 1826-1926*, 2010

## Bibliographic References (ii)

- Gunzburg/Austin Gunzburg, A. & Austin, J., *Rails through the bush*, Victoria, 1997
- Gervas Gervas, G., *Pipedream to pipeline*, Perth, 2001
- GG Government Gazette, Western Australia
- Gibney/Smith Gibney, H.J. and Smith, A.G., *A Biographical Register 1788-1938*, Canberra, 1987
- Heydon Heydon, P.R., *Gold at Peak Hill*, Carlisle, 1991
- Hooper Hooper, J.M., *Youanmi: Story of Murchison Gold*, Carlisle, 1986
- Hore-Lacy Hore-Lacy, I. (ed.), *Broken Hill to Mount Isa*, Vic., 1981 (W.H. Corbould memoirs)
- Hunt Hunt, L. (ed.), *Yilgarn: Good country for hardy people*, Southern Cross, 1988
- Firkins Firkins, P. (ed.), *A history of commerce and industry in Western Australia*, 1979
- IMR *Industrial and Mining Review* (1952-1953)
- IRMYBA *Industrial Review and Mining Year Book of Australia* (1955-1968)
- JAusMH *Journal of Australasian Mining History* (from 2003)
- JCMWA *Journal of the Chamber of Mines of Western Australia*
- JHSA *Journal and Proceedings of the Western Australian Historical Society* (from 1929)
- JIEAust *Journal of the Institution of Engineers, Australia*
- John's *John's notable Australians*, 1906
- Kennedy Kennedy, K.H., *Mining Tsar: the life & times of Leslie Urquhart*, Sydney, 1986
- KM *Kalgoorlie Miner*
- Kerr Kerr, J., *Mt Morgan, gold, copper and oil*, Queensland, 1982
- Kimberly Kimberly, W.S. (comp.), *History of WA, biographies of its leading men*, 1907
- King King, Norma, *Daughters of Midas*, Carlisle, 1988
- L.Clark Lindesay Clark, G., *Built on Gold*, Melbourne, 1983
- Le Page Le Page, J.S.H., *Building a state, the story of the PWD of WA*, Leederville, 1986
- Lloyd Lloyd, A.C. (comp.), *Leading personalities of Western Australia*, Perth, 1950.
- MacGill MacGill, G., *King Battery: Conservation Plan*, Perth, 2001
- McLaren McLaren, Glen, *Miners and Mentors: Centenary History of WASM*, Curtin, 2001
- M&SP *Mining and Scientific Press* (USA)
- Matters Matters, L.W., *Australians who count*, London, 1913
- MCER *Mining & Chemical Engineering Review* (1958-1965)
- Mennel Mennel, P., *The Dictionary of Australasian Biography*, London, 1892
- MER *Mining and Engineering Review* (1911-1917)
- MHA Mining History Association (USA)
- MJ *Mining Journal* (UK)
- MIYBA *Mining and Industrial Year Book of Australia* (1952, 1953, 1954)
- MMg *Mining Magazine* (UK)
- MPIM *Mining, Pastoral & Industrial Magazine* (1918-1919)
- MPR *Mining & Pastoral Register* (1919-1920)
- MPRBG *Mining & Pastoral Register & Builders Gazette* (1920-1923)
- MRB *Mineral Resources Bulletin* (Geological Survey of WA)
- MYBA *Mining Year Book of Australasia* (1939, 1940, 1941, 1951)
- Nash Nash, G.H., *The Life of Herbert Hoover*, vols 1 & 2, 1874-1914, 1914-1917
- Palmer.Ag Palmer, A., *Agnew*, Carlisle, 2000
- Palmer.FG Palmer, A. *Fields Gold: Yalgoo Goldfields*, Carlisle, 1981
- Palmer.Yu Palmer, A. *Yundamindra*, Carlisle, 2006
- ProcAMHAC *Proceedings of the Australian Mining History Association Conferences 1997-2000*

## Bibliographic References

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- ProcAusIME* *Proceedings of the Australasian Institute of Mining Engineers* (July 1912 to 1919)  
*ProcAusIMM* *Proceedings of the Australasian Institute of Mining and Metallurgy* (from July 1919)  
*ProcCMSSA* *Proceedings of the Chemical and Metallurgical Society of South Africa*  
*ProclCE* *Proceedings of the Institution of Civil Engineers*  
*ProcWAIE* *Proceedings of the Western Australian Institution of Engineers* (1910-1919)  
PSL Public Service List (WA)  
Quartermaine Quartermaine, K., *Visual record of Golden Mile machinery, structures etc*, 1979  
Quartermaine.PR Quartermaine, K., 'Aspects of mining at Ravensthorpe', *JHSWA* 9, 1984  
Rae Rae, Lou, *The Emu Bay Railway*, Tasmania, 1997  
Ralph Ralph, G.M., *Bullfinch and the Yilgarn Goldfield*, Carlisle, 2007  
RDM Western Australian Department of Mines Annual Report (date)  
Reid Reid, A., *Those were the days*, 1933 (rpr Hesperian, 1986)  
RH.BMC Hartley, R.G., 'Bewick Moreing', *Labour History* 65, 1993; Murdoch Uni thesis 1992  
RH.Kalg Hartley, 'Kalgoorlie gold metallurgy, 1895-1915', Murdoch University PhD 1993  
RICA Annual Report of Industrial Conciliation and Arbitration Act (date)  
Safford Safford, G., *Who's Who in Mining and Metallurgy 1908*, Mining Journal, London.  
Spillman Spillman, K., *A rich endowment: government & mining in WA 1829-1994*, 1994.  
Sprake Sprake, A., *Londonderry: The Golden Hole*, Carlisle, 1991  
Stannage Stannage, C.T., *The People of Perth*, Perth, 1979  
Stedman Stedman, C., *100 years of Collie coal*, Curtin, 1988  
*StudWAHist* *Studies in Western Australian History*  
Sykes Sykes, T., *Two Centuries of Panic: Corporate collapses in Australia*, Sydney, 1988  
*TAmerIME* *Transactions of the American Institute of Mining Engineers*  
*TAusIME* *Transactions of the Australasian Institute of Mining Engineers* (to June 1912)  
*TAusIMM* *Transactions of the Australasian Institute of Mining & Metallurgy*  
Thiel P.W.Thiel & Co, *Twentieth Century Impressions of Western Australia*, Perth, 1901  
*TIEAus* *Transactions of the Institution of Engineers, Australia*  
*TIMM* *Transactions of the Institution of Mining & Metallurgy*  
*TIMMAmer* *Transactions of the Institute of Mining & Metallurgy of America*  
Turnbull Turnbull, C.W.F., *Looking Back: Leonora...Gwalia 1895-1963*, Leonora 1999  
V&P Votes and Proceedings, Western Australian Parliamentary Papers  
WAGC *Western Australian Goldfields Courier* (1894-98)  
WAMAR *West Australian Mining Annual Review* (1937-1938)  
WAMBEJ *Western Australian Mining, Building and Engineering Journal* (1903-1927)  
WAMCR *W.A. Mining & Commercial Review* (1950-1952)  
WAPD Western Australian Post Office Directory (date)  
WArg *Western Argus*  
Webb,M&A Webb, M. & A., *Golden Destiny: Kalgoorlie-Boulder Centenary*, Kalg.-Bldr, 1993  
WestA *West Australian*  
Whitton *Whitton's Town and Country Directory* (1897-98)  
Wilson Wilson, J.G. (ed.), *Western Australian Centenary 1829-1929*  
WMail *Western Mail*  
WWA *Who's Who in Australia* (1929 to 1959)  
Young Young, G.F., *Under the Coolibah Tree*, London, 1953.

## Abbreviations of Post-nominal Awards and Distinctions

ABalSM	Associate of the Ballarat School of Mines
ABendSM	Associate of the Bendigo School of Mines
AIMM	Associate of the Institution of Mining and Metallurgy
AMAmerIME	Associate Member of the American Institute of Mining Engineers
AMAusIME	Associate Member of the Australasian Institute of Mining Engineers
AMAusIMM	Associate Member of the Australasian Institute of Mining and Metallurgy
AMICE	Associate Member of the Institution of Civil Engineers
AMIEAust	Associate Member of the Institution of Engineers, Australia
AMIEE	Associate Member of the Institution of Electrical Engineers
AOSM	Associate of Otago School of Mines
ARCS	Associate of the Royal College of Science
ARSM	Associate of the Royal School of Mines
ASASM	Associate of the South Australian School of Mines
ASTC	Associate of Swinbourne Technical College
AWASM	Associate of the Western Australian School of Mines
AWMC	Associate of the Working Men's College
AZSM	Associate of Zeehan School of Mines
BA	Bachelor of Arts
BME	Bachelor of Mining Engineering
BCE	Bachelor of Civil Engineering
BE	Bachelor of Engineering
BSc	Bachelor of Science
CMG	Commander of the Order of St Michael and St George
DipBalSM	Diplomat of the Ballarat School of Mines
DSc	Doctor of Science
FCS	Fellow of the Chemical Society
FGS	Fellow of the Geological Society, London
FIC	Fellow of the Institute of Chemistry
FRGS	Fellow of the Royal Geographical Society
FRMS	Fellow of the Royal Metallurgical Society
FSASM	Fellow of the South Australian School of Mines
FSCI	Fellow of the Society of Chemical Industry
JP	Justice of the Peace
LLB	Bachelor of Law
MAmerIME	Member of the American Institute of Mining Engineers
MAmerSCE	Member of the American Society of Civil Engineers
MAusIME	Member of the Australasian Institute of Mining Engineers
MAusIMM	Member of the Australasian Institute of Mining and Metallurgy
MBE	Member of the Order of the British Empire
MC	Military Cross
MCE	Master of Civil Engineering
MCMSSA	Member of the Chemical and Metallurgical Society of South Africa
ME	Master of Engineering
MGSA	Member of the Geological Society of Australia
MHR	Member of the House of Representatives
MICE	Member of the Institution of Civil Engineers

## Post-nominals

MIEE	Member of the Institution of Electrical Engineers
MIMechE	Member of the Institution of Mechanical Engineers
MIME	Member of the Institution of Mining Engineers
MIMM	Member of the Institution of Mining and Metallurgy
MIMMAmer	Member of the Institute of Mining and Metallurgy of America
MIMS	Member of the Institute of Mine Surveyors
MIMSWA	Member of the Institute of Mine Surveyors (Western Australia)
MLA	Member of the Legislative Assembly
MLC	Member of the Legislative Council
MNEIMME	Member of the North of England Institute of Mining & Mechanical Engineers
MSc	Master of Science
MSCI	Member of the Society of Chemical Industry
MVIE	Member of the Victorian Institution of Engineers
PhD	Doctor of Philosophy

## Gold & Mineral Fields

<i><b>Goldfield</b></i>	<i><b>Acronym</b></i>	<i><b>Mineral Field</b></i>	<i><b>Acronym</b></i>
Broad Arrow	BAGF	Collie River	CRMF
Coolgardie	CGF	Greenbushes	GMF
Dundas	DGF	Northampton	NMF
East Coolgardie	ECGF	South West	SWMF
East Murchison	EMGF		
Gascoyne	GGF		
Kimberley	KGF		
Mt Margaret	MMGF		
Murchison	MGF		
North Coolgardie	NCGF		
North-East Coolgardie	NECGF		
Peak Hill	PHGF		
Phillips River	PRGF		
Pilbara	PGF		
West Kimberley	WKGf		
West Pilbara	WPGF		
Yalgoo	YaGF		
Yilgarn	YIGF		

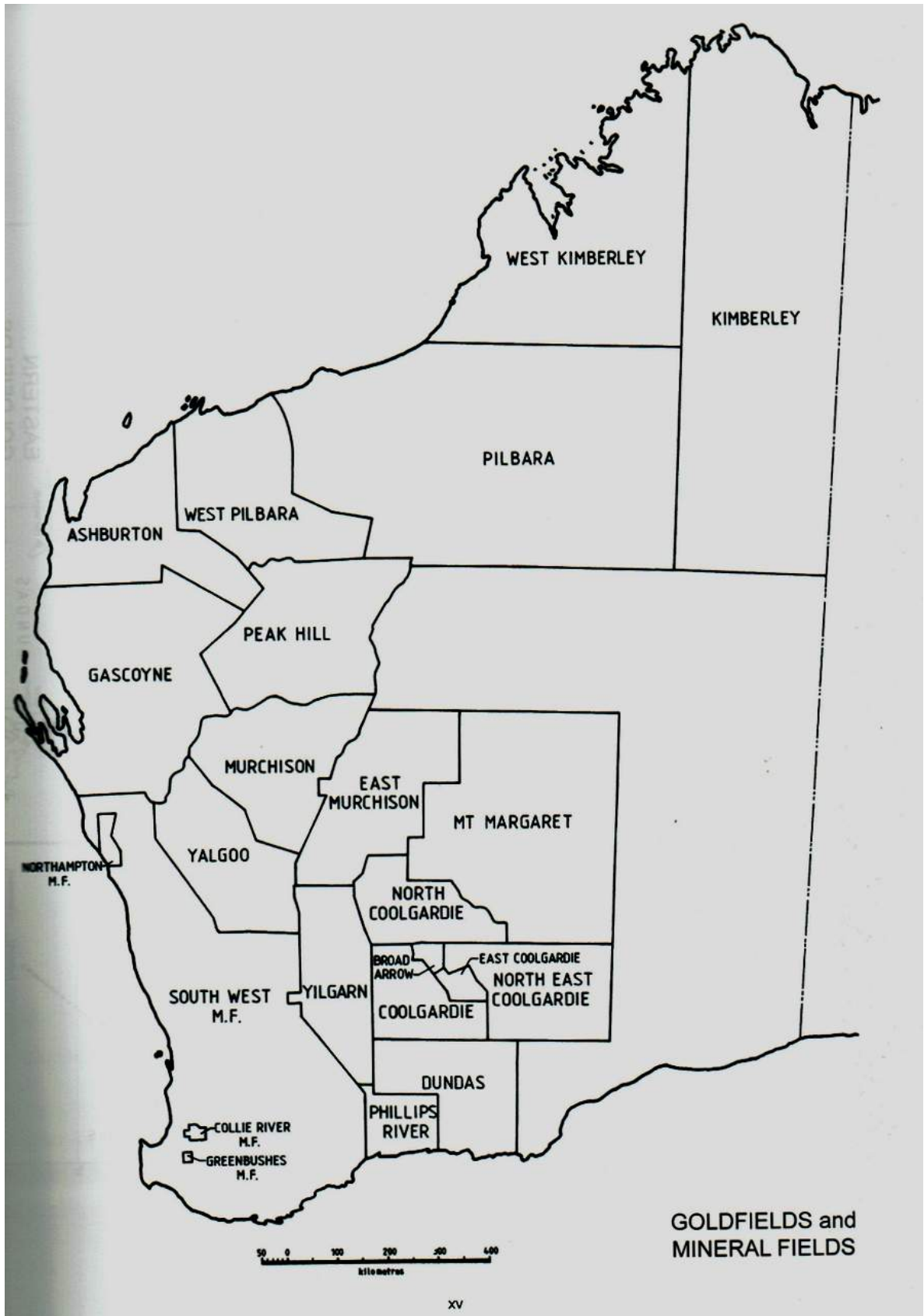
## Location of Mines

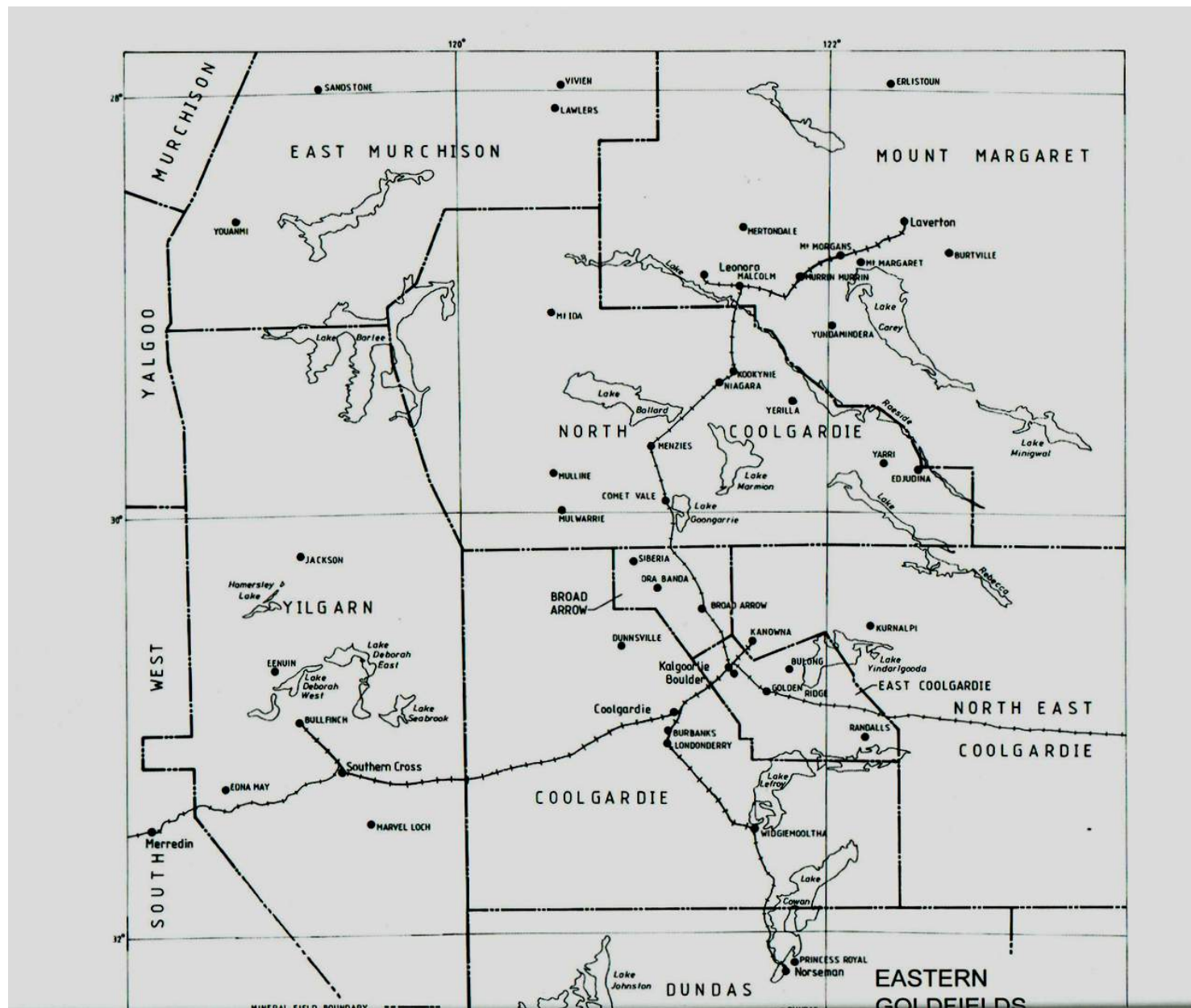
To assist in the location of gold mines in this text the goldfield in which a mine was located is indicated in brackets after the name of the mine together with the name of the nearest town (or former town). For example: Sons of Gwalia Ltd (MMGF Leonora) indicates that the Sons of Gwalia mine was located in the Mount Margaret Goldfield near Leonora.

The Goldfields and Mineral Fields used in the text and shown in Figure 1 are those which existed in 1952. The boundaries of goldfields at earlier dates are not used as when the early goldfields were proclaimed they often covered areas which were later proclaimed as separate goldfields.

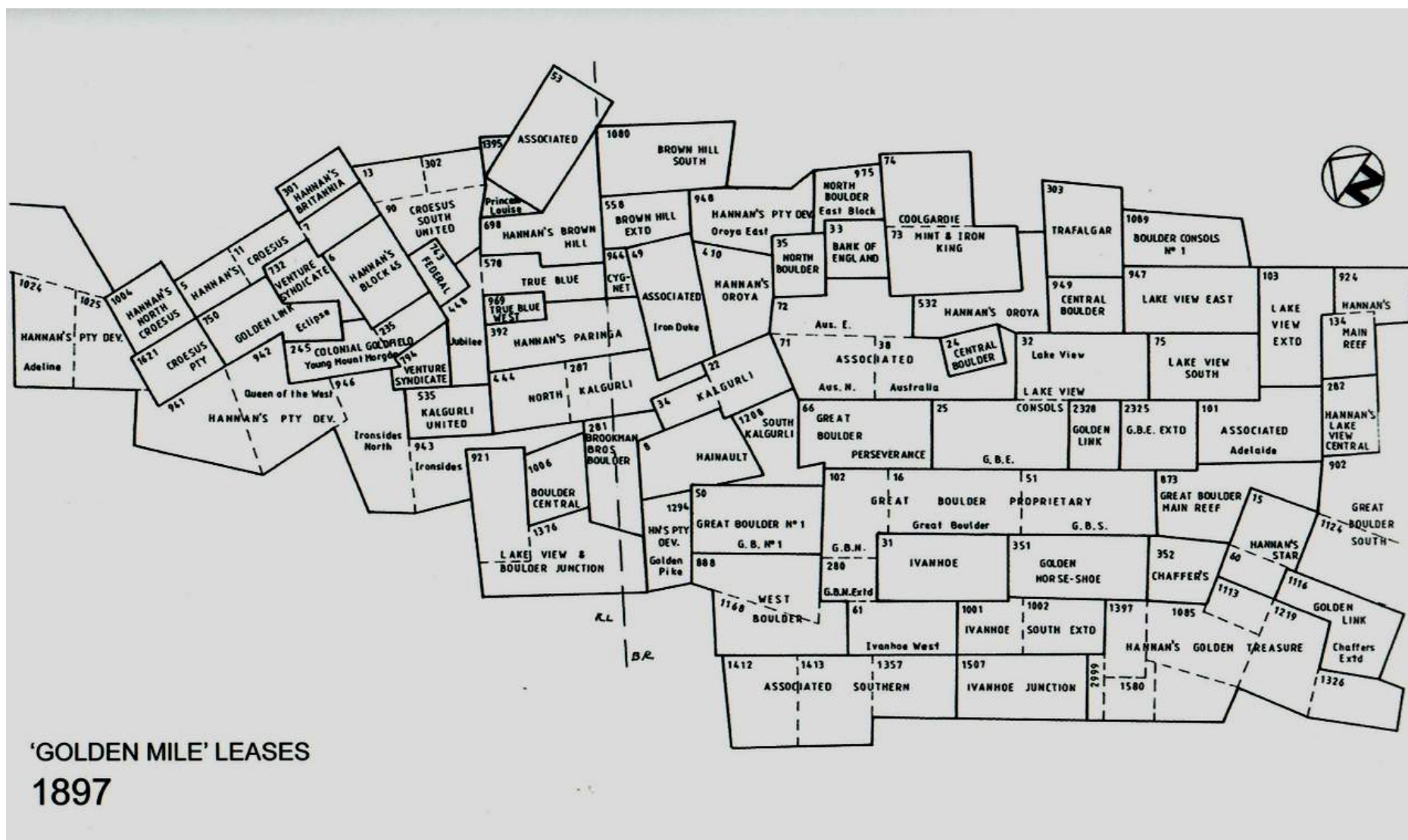
The Goldfields Districts into which Goldfields were divided are not used in this book to locate mines as the boundaries of Districts varied much more than those of Goldfields and their use can be confusing.

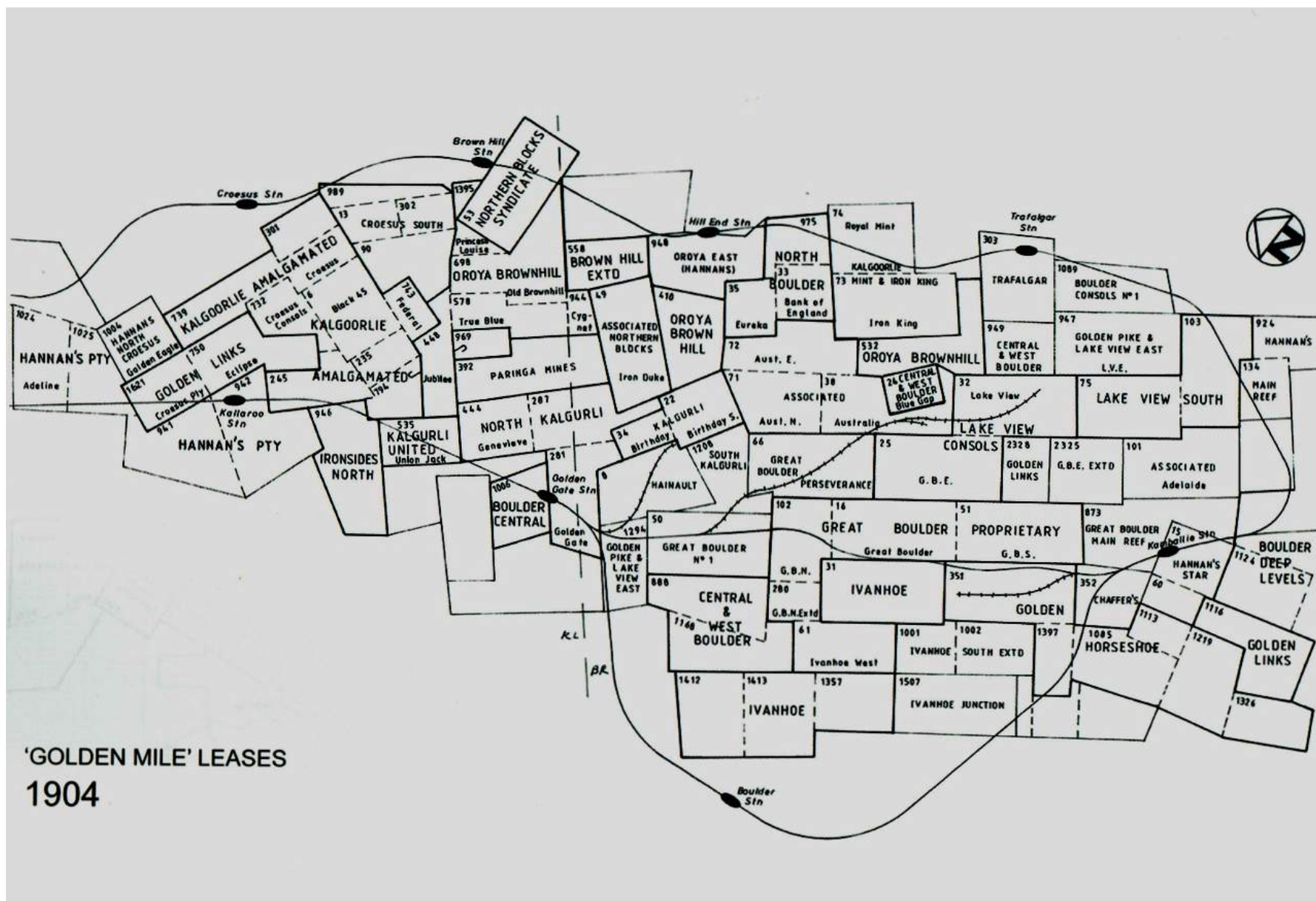
To locate mines and leases within that area of the East Coolgardie Goldfield which includes the Golden Mile and adjacent parts of Boulder and Kalgoorlie (as shown in Figures 3 to 6) the Golden Mile has been divided into two parts: Kalgoorlie (the northern) and Boulder (the southern). The (somewhat arbitrary) boundary between the two has been drawn as a straight line along the southern boundary of the Hannan's Brownhill lease and near the Golden Gate railway station.





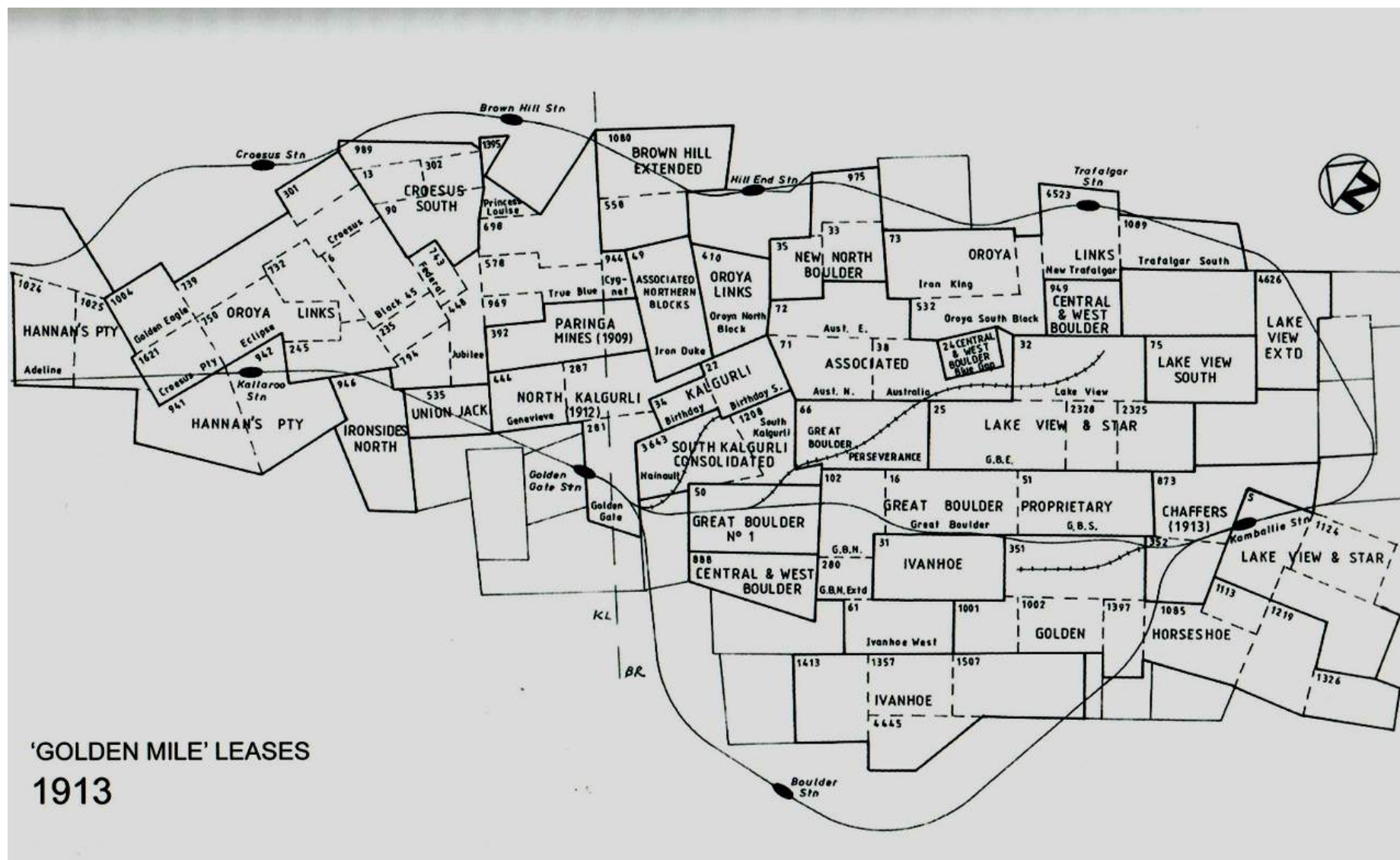






'GOLDEN MILE' LEASES  
1904





'GOLDEN MILE' LEASES  
1913



## Acknowledgements

It has been over twenty years since Denis Cumming and I first decided to work together to prepare material for this book. Since that time so many people have assisted us that it is impossible to thank them all personally. In the early 1990s we both spent many hours in the Battye Library of Western Australian History, the State Reference Library and the State Records Office researching relevant material and we were very grateful to the librarians and archivists who helped us and pointed us in useful directions. We also appreciated the help given to us by the Australasian Institute of Mining and Metallurgy and for the Institute allowing Denis to search their archives in Melbourne for career records of their members. The many references to these records in the footnotes to this book attest to their value. We also thank the Chamber of Mines of Western Australia for access to their archives. The Chamber's Monthly Journal and, in particular, the quarterly listings of mining companies affiliated to the Chamber and their representatives provides a valuable resource for tracing the movements of mining staff within the industry. Since Denis's sudden tragic death I have continued to research (or to accumulate, or pick up, material relating to, might be a more accurate description) the careers of mining engineers and technologists while researching mining history at Murdoch University and subsequently. At the University this research involved, in particular, an honours thesis relating to the mining consultant company, Bewick Moreing and Company, and one of its partners, Herbert Hoover, and also a doctoral thesis on the history of Kalgoorlie gold metallurgy from 1895 to 1915. I am very grateful for the help given me by my supervisor for this work, Dr Lenore Layman, and for her continuing advice and friendship. During the 1990s I had assistance in my research from a number of libraries and archives. In Perth these were the Geological Library of the Department of Mining and Petroleum, the Physical Sciences and Geology Department Libraries of the University of Western Australia, Murdoch University Library and the Perth Branch of the Australian Industrial Property Organisation (formerly the Australian Patent Office). In Kalgoorlie it was the Kalgoorlie Resource Centre which incorporated the older holdings of Curtin University's Western Australian School of Mines. In the United Kingdom I was assisted in accessing the records of Western Australian mining companies registered in London at the Guildhall Library and the Public Records Office and also early British mining journals at the British Library Science Reference and Information Service (Aldwych) and Imperial College Library. In the USA I received assistance at the Herbert Hoover Presidential Library (West Branch, Iowa).

I was very grateful to Mrs Robin Hamilton for permitting me to study the letter books of her late husband's grandfather, Richard Hamilton, manager of the Great Boulder mine, which covered the crucial years of plant development on the Golden Mile from 1897 to 1900. I am also indebted to Mr Ron Manners, who allowed me to study the patent register of his grandfather, W.H. Manners, who, as the only patent attorney resident in Kalgoorlie during the 1900s, was responsible for obtaining patents for most of the metallurgical inventions made there during that period. I am also grateful to Mrs Norma Latchford, who was archivist for Kalgoorlie Consolidated Gold Mines in the 1990s, who kindly located material for me in the archives of that company whose leases now cover most of the Golden Mile. Mr Les Annison, then Director of the Survey and Mapping Division of the Department of Mines and Petroleum, and his staff, kindly assisted me in accessing material in the Bewick Moreing Collection of mine inspection reports held by the Department.

My colleagues in the Australasian Mining History Association have encouraged me in the preparation of this book and several have been most generous in providing me with information from their researches, in particular Professor Ian Phimister, Professor Jeremy Mouat, Mr Mel Davies, Dr Patrick Bertola and Professor Ron Limbaugh. Both compilers greatly appreciated the store of information and advice made available to us by Keith Quartermaine of Kalgoorlie. His encyclopedic knowledge of the Goldfields, his insistence on accurate scholarship and his wry sense of humour has been sorely missed by all his friends. Sadly he died shortly after Denis.

A number of people have kindly given me information about their relatives who were engineers on the goldfields at the turn of the century. I am particularly grateful to Mrs Anthea Fleming who generously gave me a copy of the transcript made by her mother of the letters of the latter's grandfather, William de Mole, mining engineer and surveyor, which he sent from the Eastern Goldfields to his wife in Victoria between 1895 and 1903. The letters give valuable insights into the operation of independent engineers working for company mines on the goldfields. Mrs Fleming also gave me valuable information about F.R. Feldtmann who was Bewick Moreing's manager in Western Australia from 1899 to 1902 and who was Mrs Fleming's great grandfather. I am also grateful to Mrs D. Watkins and Mr R. Hooker for providing very useful information on their relative's work on the goldfields and to Mrs Tess Thomson of the Eastern Goldfields Historical Society for information on W.J. Koehler.

I found to my surprise, but probably no one else's, that intermittent work on this book over such a long period was more difficult than writing historical work to a stricter timetable, particularly when its successful completion often seemed in doubt. This book could not have been written, far less completed, without the patient and tolerant support of my wife, Patricia, to whom I cannot be sufficiently grateful.

R.G.H.

# INTRODUCTION

## **Scope**

This book of career biographies of early 20<sup>th</sup> century mining engineers and metallurgists, which the late Denis Cumming and I have compiled, contains biographical articles about the careers of 306 of the leading mining engineers, mine managers and metallurgists who worked in the Western Australian mining industry between 1890 and 1920. The text includes information about members' education and the whole of their careers in the mining industry including their time in mining before coming to Western Australia and after leaving the state, for those who moved on. A number of those who left Western Australia went on to have distinguished careers elsewhere. All those with entries worked for some or all of their careers at Western Australian mines and a number were also associated with their management after leaving the state.

The book has had a long period of gestation mainly due to the untimely death of my colleague. The project started over 20 years ago in the early 1990s when Denis and I discovered that we were both researching the same group of people and we decided to pool our efforts. When we had combined our research data we found that we had as many as 940 people in our three employment categories up to 1940. This number was a reflection of the huge size of the gold mining industry in Western Australia in the early twentieth century. In the state before 1930 there were no less than 4900 underground mine sites which produced gold. Of this total 780 produced over 1000 ounces or 30 kilograms of fine gold.

Because of the numbers involved we decided to restrict our biographical work to the 'golden era' generation who were most active between 1890 to 1920, the years when the modern mining industry in Western Australia was founded. This time frame encompasses the key period of the mid 1900s when Kalgoorlie led the world in gold metallurgy and process plant development. To be more exact we limited our cohort to those who had finished their mining training before the First World War.

This left us with 700 entries from which a preliminary 300 were chosen for whom we thought more detailed treatment was needed. Although over the years there have been a good many additions and deletions to that cohort, somewhat fortuitously the number included in the book in the end came very close to the number originally chosen. In the book twenty 'outstanding persons' in the industry are featured in longer articles of over 1000 words and a further thirty 'particularly noteworthy persons' have biographical pieces which extend to between approximately 500 and a 1000 words in length. The remaining entries generally contain between 100 and 400 words. It could be argued that at least another twenty persons could be added to the 'particularly noteworthy' category. The original 20 were my personal choices and these tended to favour persons whose sources contained more interesting and informative material. On the other hand the information on the careers of a number of promising candidates was limited by poor source material. Such problems are no doubt encountered by all editors of biographical digests but unfortunately they cannot always be overcome. In the list of career biographies (pages vi to viii) the names of the 20 'outstanding persons' are printed in bold while those of the 'particularly noteworthy persons' are underlined.

In addition to the 306 persons whose career biographies are contained in this book, our records also contain the names of 439 mine managers and mining technologists who worked in Western

Australia during the same period. Although limited personal information is available about most of them we have determined at least one or two mines at which each worked and the periods for which he was employed. This information may possibly be of use to family and local historians and has therefore been tabulated in Appendix A of this book.

## **Innovations**

The innovations in mining and metallurgical technologies made in Western Australia were extremely important in elevating the state's industry, and particularly Kalgoorlie's, to a leading position in world mining, albeit only for a brief period in the mid 1900s. The leading innovations made between 1890 and 1920 are listed in Appendix B so that they can be more readily related to the relevant career biographies. In particular these innovations included: the introduction of filter presses for processing slimes, tube mills for fine grinding, adaptation of the Wheeler pan for fine grinding, the Diehl process utilising bromocyanide in the cyaniding of sulpho-telluride ores, the 'dry crush, roast and sliming' process for treating sulpho-telluride ores, the first continuously operated drum vacuum filter, Ridgway's Mk1 continuously operated vacuum filter, the first large-scale wood-fired downdraft gas producers, the first continuous counter-current decantation in WA, pulverised charcoal used for zinc dust in the Moore-Edmands gold precipitator.

## **Sources**

The list of sources referred to in researching the entries in this book are listed on pages ix to xi. A good many of these, of course, relate to only a limited number of entries. It may be of interest to readers if the most commonly used sources are noted below in the approximate order in which they were most often used. The abbreviations used are those noted in the Bibliographic References.

- a) Contemporary institutional records
  - *The Monthly Journal of the Chamber of Mines* and its quarterly lists of affiliated mining companies and their representatives. (JCMWA)
  - The archives of the Australasian Institute of Mining and Metallurgy. (ArcAusMM)
  - *Skinner's Mining Manual*, issued annually in London. (Skinner)
- b) Australian, British and American mining magazines. (WAMBEJ, CEMR, AMER, MER, AMS et seq, MMg, MJ, E&MJ, M&SP)
- c) Transactions (and Proceedings) of Australian, British and American mining and engineering institutions/institutes. (TAusIME, TIMM etc)
- d) Mining biographies and histories. (Blainey, L.Clark, Davies, Hore-Lacy, Kennedy, Nash 1)
- e) Newspapers. (WMail, WArgus, CM, KM, WAGC, WestA)
- f) Contemporary descriptions of WA and citizens, records from newspapers. (Battye, Kimberly, Reid, Theil)
- g) Contemporary discussions of mines, international mining 'Who's Who'. (Clark, Clelland, Eissler, Safford, Charleton)
- h) Western Australian Parliamentary Papers – Royal Commissions, Departmental Annual Reports. (V&P)



### ***Aims and Limitations***

Compiling this book has been somewhat of a pioneering task as it is probably the first attempt that has been made to outline the careers of a whole generation of mining engineers working in a single Australian state. It was a remarkable generation which developed one of the great mining centres of the world despite the legacy of the extremes of London speculation. In the process it made Kalgoorlie for a short time the world leader in gold metallurgical innovation and spread its expertise over the thousands of square kilometres of the state's goldfields. In embarking on the book we were aware of the limitations associated with such an enterprise. Variations in the amount of useful source material, for example, has meant that the entries for several likely candidates have been shorter than we would have wished. Career biographies are also necessarily limited as they lack family details and other background information. I hope that in future other writers will be able to produce fuller biographical studies of some of the interesting leaders of the mining industry in the golden era. I invite readers to advise me of any factual errors in this book and to also provide further information about entries for inclusion in the book should a second edition be considered.

R.G.H

## **Units of measurement**

Original units used in the period 1890 to 1930 have been used throughout this document except that long distances are given in either miles or kilometres. Conversions of original units quoted in the text to metric units are as follows.

Gold was measured in troy weight.

24 grains = 1 pennyweight (dwt) = 1.556 grams

20 pennyweight = 1 ounce troy = 31.1034 grams

Ore was generally measured in long tons (avoirdupois) but some companies used the short ton.

1 long ton = 2240 pounds (lb) = 1016 kilograms

1 short (US) ton = 2000 pounds

Other original measurements used in the text are:

1 foot (12 inches) = 304.8 millimetres

1 gallon (imperial) = 0.1605 cubic feet = 4.5467

1 pound sterling (£ 1) = 20 shillings = 240 pence

## **Abbreviations used in the text for the titles of mining companies**

GM        Gold Mine

GMs      Gold Mines

GMg      Gold Mining

GMgCo   Gold Mining Company

# FOREWORD

LENORE LAYMAN

Goldfields attract historians as they have enticed gold seekers of all kinds across time. The fields offer a rich lode to be mined and all types of historians as well as reminiscence and memoir writers, genealogists, story tellers and mythmakers have been attracted to the fascinating world of prospectors, miners, entrepreneurs, engineers and technologists, companies, traders, townspeople and travellers to exotic locations.

Gold drove Western Australian development in the 1890s-1900s when WA's eastern goldfields were second only to the Witwatersrand in productive wealth and a world leader in metallurgical innovation; when goldfields towns were among the colony's largest and most cosmopolitan and lively. Historians have researched that past, some parts more thoroughly than others. The region's overarching role in Western Australia's economic and political history in the 1890s has been told WA's first great decade of economic and political development, its first mining boom and its engagement with federation. Geoffrey Blainey in *The Rush that Never Ended* and further writings has provided an overview of WA's place in Australian mining history to which other mining historians have added significantly. Keith Quartermaine collected and preserved thousands of goldfields mining photographs. Labour historians, beginning with H.J. Gibbney, have highlighted the importance of workers and unions in the goldfields story. Family and local histories have produced many powerful narratives of family lives shaped by migration to and from the fields. Town and regional histories have explored the cosmopolitan urban spaces which formed, briefly flourished and almost as quickly disappeared across the region. Reminiscences and memoirs have recounted prospectors' experiences of the outback and the ever-alluring promise of a rich find. Familiar goldfields stories are now embedded in the popular imagination. Aboriginal historians have begun to add pre- and post-contact indigenous histories to the goldfields story. And we are beginning to see environmental studies of the mallee and mulga, and the historical life of the semi-arid rangelands.

One aspect of goldfields history, not yet mentioned but crucial to mining success, is that of mine management and technology - the work of the mining engineers, mine managers and metallurgists. This subject has most fortunately engaged the interest and skills of Dr Richard Hartley, engineer and historian. He is author of the prize-winning monograph *The River of Steel, a history of the Western Australian Goldfields and Agricultural Water Supply 1903-2003* (2007) as well as several valuable compendiums - *Industry and Infrastructure in Western Australia 1829-1940* (1995) and *A Guide to Printed Sources for the History of the Eastern Goldfields*

*Region of Western Australia* (2000). Richard's 1992 History Honours thesis, 'The 1904 watershed in Bewick Moreing's Western Australian gold mining activities', and his 1998 PhD thesis, 'A history of technological change in Kalgoorlie gold metallurgy 1895-1915', are important additions to historical knowledge of the eastern goldfields.

Richard Hartley's expertise and commitment have happily combined with those of the late Dennis Cumming and this digest of the career biographies of 306 of a 'remarkable generation' of mining engineers, mine managers and metallurgists is the result. I congratulate Richard on an excellent outcome which honours Dennis's contribution and provides for everyone interested in mining and goldfields history a wonderful resource which will be widely utilised. It is a splendid achievement.

### A

#### **AARONS**, Gabriel MIMÉ

Aarons managed the Londonderry mine (CGF Londonderry) in 1895 when, under the control of R.G. Casey and R.S. Black (both q.v.), the mine began to be operated as a public company and it was discovered that the very rich ore of the surface outcrop did not extend to depth. He resigned his post on August 12 1895. In the following year he managed Hannan's 100 Acres Ltd and Hannan's Mount Ferrum Gold Mines Ltd (both ECGF) and in 1897 worked as a consulting mining engineer in Kalgoorlie, a practice which he continued into the 1920s. In 1899-1900 he was consulting engineer for Hannan's Mount Ferrum G.Ms.

WAGFC Jan 1895; Skinner 1897, 1899, 1900; Sprake

#### **AARONS**, Julian Boyd ARSM, MIMM, MAusIME, MAmerIME (c.1877-1953)

Born in Sydney and educated at Sydney Grammar School, Aarons studied mining and metallurgy at the Royal School of Mines in London from which he graduated in 1899. He returned to Australia to become mill manager at Great Boulder No.1 Ltd. (ECGF Boulder) in 1900. He was metallurgist at the Sabiwa Gold Mining Company in Rhodesia in 1902, and became manager of the Imani GM Company and V.V. (Gwanda) Syndicate in 1903 (both Rhodesia). He returned to Western Australia to join Bewick Moreing and Company, mine managers and consultants, as superintendent of the White Feather Main Reefs Ltd (NECGF Kanowna) in 1904 shortly before it closed, and became superintendent of the Boulder Deep Levels Ltd (ECGF Boulder) in 1905 and of the White Feather Main Reefs (1906) Ltd in the following year when the mine was re-opened. He was the general manager of Chaffer's GMg Co (ECGF Kalgoorlie) in 1909-16 and also of the Bullfinch East Gold Mine (YGF Bullfinch) in 1911. He gave evidence to the Royal Commission on Miners' Lung Disease in 1911, and was on active service in the AIF in 1917-8. During the 1920s he became superintendent of mines for Pacific Coast Borax, a position which he held until his retirement in 1946. He was appointed a director of the US Borax Company in 1943 and was president of that company from 1949 until his death. He was an associate of the Institution of Mining and Metallurgy and a member of the American Institute of Mining Engineers, and was elected a member of the Australasian Institute of Mining Engineers in 1909. His papers include 'High grade bullion from zinc box precipitates', jointly with H. Black (q.v.), *JCMWA* 10, 1911, pp.204-08.

*JCMWA* 1904, 1910, 1917; Skinner 1909; *WAMBEJ* Feb 1909, Jul 1914; *Bull IMM* Sept 1953; ArcAusMM.

## WESTRALIAN FOUNDERS OF 20<sup>TH</sup> CENTURY MINING

**ADAM**, John (Jock) ABalSM, MAusIMM (c.1875-1955)

Adam was born at Clunes in Victoria and studied at the Ballarat School of Mines from which he graduated in geology, mine surveying and metallurgy and obtained a mine manager's certificate. He worked for a year at the Victoria United mine in Ballarat and then, in 1905, he joined Bewick Moreing and Company, mining consultants and mine managers worked at Loddon Valley Goldfields Ltd in the Talbot district of Victoria and at the Great Fitzroy Mines Ltd at Mount Chalmers in Queensland for seven years from 1907. Elected a member of the Australasian Institute of Mining Engineers in 1910, he was underground manager at the Sons of Gwalia Ltd (MMGF Leonora) in 1914 and was superintendent of Great Fingall Consolidated at Day Dawn (MGF) in 1916. He returned to the Sons of Gwalia to become superintendent in 1917. He was chairman of the Leonora-Malcolm Road Board and gave evidence to the Royal Commission on Mining in 1925. When he left Gwalia in 1927 he had been the longest serving manager of the mine. He moved to Broken Hill to become assistant superintendent of the Zinc Corporation, arguably the most important mining company managed by Bewick Moreing in Australia. He retired as the Zinc Corporation's manager at Broken Hill in 1937 to take up farming near Wangaratta in Victoria. On the death of Victor T. Edquist, the general manager of Bewick Moreing in Australia, in 1944, Adam returned to the company as acting general manager based in Melbourne, a position which he held until July 1947 when H.V. Rowe, previously the superintendent of the Sons of Gwalia, took over as Bewick Moreing's senior representative in Australia. When Adam retired the second time he had worked for Bewick Moreing for a total of 35 years.

*LCER* 1916; *JCMWA* 1917, 1920; *Skinner* 1914, 1920; *MCER* May 1955; *ArcAusMM*

**AGNEW**, John Alexander AOUSM, MIMM, MIMMAmer, MAusIMM. (1872-1939)

Born in New Zealand Agnew graduated from the Otago School of Mines with a mine manager's certificate and was working in Western Australia in 1896. He was employed by Bewick Moreing and Company (BMC), mine managers and mining consultants, as underground manager at the Sons of Gwalia Ltd mine (MMGF Mt Malcolm) at Gwalia near Leonora, under H.C. Hoover (q.v.) and then R.H. James (q.v.) in 1898-99. In October 1899 he was transferred to Tientsin in north-eastern China where he worked as assistant to Hoover. During the Boxer rebellion Agnew and Hoover were among the Europeans who were besieged in Tientsin until relieved by allied troops. In September 1900 Agnew's work in China was completed and he returned to Western Australia to continue working for BMC. Meanwhile in London, in December 1901, Hoover had been made a partner in BMC and became responsible for operating all mines managed by BMC which were then principally in Western Australia.

In February 1902 Agnew was manager of a mine at Pendinnie near Lake Carey (NCGF Mt Morgans). In 1904 he managed the Golden Age Consolidated Ltd mine at Wiluna (EMGF) shortly before its closure and then the Vivien GMG Co.'s mine, 16 km north of Lawlers (EMGF). At the beginning of 1905 he managed the closure of East Murchison United Ltd (EMGF Lawlers and Waroonga). Later in 1905 he took over the management of the Lancefield GMG Co's mine at Laverton. (MMGF). BMC's agency company, London & Western Australian Exploration Co., had worked this large low grade deposit under option from 1902 until it was acquired in 1904 by the Lancefield company. Hoover hoped that the mine would be a model for future large scale mining of low grade deposits. Agnew had only been there for a short time when he was transferred to Kookynie to take over the management of the Cosmopolitan Pty Ltd mine (NCGF Niagara). When Bewick Moreing's general manager in Western Australia, W.J. Loring, (q.v.) was made responsible for all Bewick Moreing's Australian operations and moved to Melbourne in 1905, Agnew was made assistant general manager, responsible to Loring for the company's Western Australian activities. He was also made manager of the BMC's agency and exploration company, London & Western Australian Exploration Co. (1906-10) and of its successor London, Australian & General

## WESTRALIAN FOUNDERS OF 20<sup>TH</sup> CENTURY MINING

Exploration Co. (1911-1912). Both companies employed inspecting engineers to visit and report on mines which were starting up. They then advised Bewick Moreing which might be bought and developed by a public company. During the 1900s it became progressively more difficult to successfully launch new Western Australian mining companies as fewer promising prospects were discovered and mining investors in London were turning to other mining fields.

Agnew was elected a member of the Australasian Institute of Mining Engineers in 1908 and of the Institute of Mining and Metallurgy of America in 1909. Agnew returned to manage the Lancefield mine the treatment plant of which required reconstruction. The new plant successfully treated the ore but its maximum throughput was uneconomical and the mine was closed in 1909.

Agnew was appointed general manager of BMC in Western Australia in 1912. The following year he left the company and moved to London where he became an independent mining consultant associated with Herbert Hoover who, having left BMC in 1908, had become an international mining financier. In July 1914 Agnew began to work full time for Hoover and to act as his alternate on various boards of directors as Hoover's time was increasingly taken up with philanthropic work in war-torn Belgium. In 1915 Agnew became a member of the technical committee which was formed to advise Lake View and Oroya Exploration Company (the financial group formed after the amalgamation of Lake View Consols and Hannan's Star), and also Yuanmi Gold Mines (EMGF, Black Range, Sandstone) of which Agnew was also a director. He became a director of the Bawdin Syndicate, a group formed to refinance Burma Mines Ltd which operated a very large silver-lead-zinc mine in north-eastern Burma. In 1920 he became a director of the Zinc Corporation of Broken Hill and of Francois Cementation Company. In the 1920s he was appointed a director of the London-based mining finance house Consolidated Gold Fields of South Africa and in 1928 he was elected to the board of Lake View and Star Ltd (ECGF Boulder). On his advice the operating subsidiary of Consolidated Gold Fields, New Consolidated Gold Fields, provided capital for the further development by Lake View and Star of the Chaffer leases adjoining those of Golden Horseshoe Estates Company Ltd which were acquired in 1929. In the same year Agnew became chairman of Lake View and Star and, under his guidance, the mine undertook extensive modernisation. Underground transport was reorganised and electrified, ore treatment was centralised and froth flotation was adopted. Both mining and processing costs were substantially reduced. Agnew was made chairman of Consolidated Gold Fields Ltd in 1934. He received the Gold Medal of the Institute of Mining and Metallurgy shortly afterwards.

In 1930 W.S. Robinson, the Australian mining financier, formed Gold Mines of Australia Ltd which was backed by a group of international mining companies including Consolidated Gold Fields. Agnew became a London director of Gold Mines of Australia in 1930 and, in 1934, a director of Gold Exploration and Finance Company of Australia Ltd., which had financial oversight of the group. He was a member of the London advisory committee of Western Mining Corporation and of Triton Gold Mines NL (MGF Reedy's Find near Cue) of which he was also a director. In Kalgoorlie the Robinson group formed Gold Mines of Kalgoorlie Ltd (ECGF Boulder, Kalgoorlie) to consolidate leases mainly on the eastern side of the Golden Mile. Agnew was thus associated with the two most powerful groups on the Golden Mile, Lake View and Star and Gold Mines of Kalgoorlie, which by 1939 had become rival organisations. In 1939 Agnew was also chairman of directors of Wiluna Gold Corporation but in that year he died in California.

*JCMWA* 1904, 1905, 1908; *WAMBEJ* 7 Oct 1905; *MER* July 1912; Skinner 1915, 1920; 'Obit' *MER* Aug 1939; *MCER* 31; *ProcAusIMM* 115, 1939; *TIMM* 49, 1939; L.Clark; Bertola; ArcAusMM; LV&S 1960

**AGNEW**, Rudolf John AWASM, MIMM, MAusIMM. (1896-1960)

The son of John (above), Agnew studied mining at the Royal School of Mines in London in 1915-16. While working in Kalgoorlie as an assistant surveyor at the Ivanhoe Gold Corporation (ECGF Boulder) in 1920 and as a surveyor at Great

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Boulder Perseverance Gold Mining Co. Ltd. (ECGF Boulder) in 1923, he completed the associate diploma course at the WA School of Mines in 1924. He returned to England to become the surveyor at the Mill Close mine in Derbyshire in 1925. He worked as assistant general manager of the Central European Mines at Klagenfurt in Yugoslavia in 1928, and as general manager of the Societe an Miniera Cave del Predil at Raibl in Italy in 1931. He returned to Western Australia to become, in 1932, general manager of Goldfields Australian Development Company Ltd., one of the companies which was formed by Claude de Bernales and which had a mine at Kintore near Kunanalling (CGF). Agnew was elected a member of the Australasian Institute of Mining and Metallurgy in 1933 and in 1936 was an executive councillor of the Western Australian Chamber of Mines. He was at Wiluna in 1933 with Wiluna Gold Mines Ltd which was developing a very large low grade refractory orebody with treatment by flotation, roasting the concentrate and cyaniding the calcine. Agnew became general manager of Wiluna GMs in 1937, the year in which the company produced 150 thousand ounces of fine gold. In 1940 he was a director of Yellowdine Investments Ltd. (YGF, Yellowdine) which had a peak annual production of 27 thousand fine ounces in 1937. He was general manager of Goldfields Australian Development Company in 1940, a director of the company in 1943, and chairman of its board in 1948. He was appointed a director of the Lake View and Star Ltd (ECGF Boulder) in 1946, and was general manager of the company from 1950 to 1960. He was the president of the Australasian Institute of Mining and Metallurgy in 1955-6 and was one of its councillors for many years. His presidential address was published as 'The development of Western Australian gold mining' (*ProcAusIMM* 177, 1956). He was president of the WA Chamber of Mines between 1950 and 1960.

*MER* May 1937, Aug 1937, June 1953, Jul 1953, Jul 1957; *MYBA* 1940, 1959; *CMWA* 1950, 1960; *TIMM* 71, 1961-2; *ArcAusMM*

**ALLAN, L.** ABalSM, MIMM.

(c.1882-1931)

Born in Australia, Allan graduated from the Ballarat School of Mines in 1900 and moved to Western Australia. There he became metallurgist and surveyor at the Morning Star Quartz Co. NL (MGF) at Mount Magnet which produced 29 thousand fine ounces of gold in 1902-09. In 1907 he was assayer and surveyor at another mine and subsequently managed two other mines. In 1909 he became manager of a new company, Morning Star GMs Ltd, which mined the same ground as the Morning Star Quartz Co. In 1913 he was manager of the Royal Standard GM (CGS) at Londonderry. After mining on his own account in 1914, he enlisted in the AIF in 1916, and was demobilised in Nigeria in 1918. Most of his remaining career was spent in Nigerian mining.

*TIMM* 1931

**ALLEN, Francis Bowen** MA, BSc, AOSM, MAusIMM.

(b.1867)

Allen gained an MA and a BSc degree in mathematics and physics at the Otago School of Mines in New Zealand, together with diplomas in mining and metallurgy. He succeeded A. Montgomery (q.v.) as principal of the Thames School of Mines on the Hauraki Peninsula of North Island, New Zealand, in 1899. In 1902 he was appointed the inaugural director of a School of Mines for the Western Australian Eastern Goldfields which was to be located in the building in Coolgardie which had housed the Coolgardie Exhibition of 1899. Before classes commenced on 3 November 1902 Allen prepared a report for the Mines Department on the Phillip's dry concentrator. As most of the 60 students were in full-time work duplicate classes had to be held in the evenings. When Premier James officially opened the school on 24 January 1903, he announced that because of Kalgoorlie's rapid growth a 'large school' of mines would also be established in Kalgoorlie. Allen had already advised on the plans of the new school and had selected some of its equipment. In April 1903 a contract was let for its construction in Egan Street, Kalgoorlie, and in November 1903 the first classes began for the 100 full and part-time students enrolled.



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From June 1904, Allen was one of three Royal Commissioners who investigated the alleged salting of gold ore samples at the Boulder Deep Levels Limited's mine at Kalgoorlie and its consequences. While the Commission was still preparing its report another controversial mining matter arose which the newly formed Daglish Labor Government decided to refer to a second Royal Commission consisting of the same members as those for the Deep Levels Commission. The second case concerned variations in estimates of gold reserves at the Great Boulder Perseverance Gold Mining Co. Limited's Kalgoorlie mine and to what extent false information was passed on to share-holders.

On the Egan Street campus Allen established a minerals museum in 1907, a heat engine laboratory in 1914, and a metallurgical laboratory from 1917. A significant change in the day to day administration of the School of Mines occurred in 1905 after the sudden death of Alex Purdie, the State's Director of Technical Education. The Public Service Commissioner, Martin E. Jull, in the interests of economy, opposed the appointment of a new Director of Technical Education while Allen held the position of Director of the School of Mines. The Education Department was responsible for Technical Education while the Mines Department controlled the School of Mines and the mining industry resisted any move to take away 'its institution'. In December 1905 Allen was appointed Director of Technical Education whilst still retaining his position as Director of the School of Mines. In the Technical Education position he was responsible for Perth Technical School and others including those at Fremantle, Guildford and Boulder. He was required to be resident in Perth which meant that his assistant at the School of Mines, T. Butement (q.v.), now designated Assistant Director, shouldered more of the School's teaching and administration.. During the 1920s technical education in Western Australia kept pace with the state's expanding economy whereas attendances at the School of Mines fell with the depression in mining. Allen fought hard and successfully to retain the School of Mines' three year associate diploma courses despite the limited number of students. By contrast, in 1918, the Perth Technical College (with its name changed from School) lost its tertiary standard courses. Allen retired in 1928 and was succeeded at the School of Mines by Butement who was termed Acting Director. Allen's published papers included:

'Mining education', *WAMBEJ*, 9 & 16 June 1906; 'Report of Western Australian School of Mines', from 1904; 'Report of Director of Technical Education' from 1908.

RDM 1902, 1903, 1930; *WAMBEJ* 11 Apr 1903, 20 Jan 1906; RDEd 1908, 1909, 1911, 1915, 1930; Battye 1, p.488; Gibney/Smith 1, p.11; White pp. 6-7; McLaren pp.1-82

**ALLEN**, James Semmens MIMM.

(d.1945)

Allen studied mining engineering at Bendigo School of Mines and was manager of Menzies Consolidated G Ms (NCGF Menzies) in 1895. He joined Bewick Moreing and Company, mining consultants and mine managers, and was manager of the Golden Age Consolidated Ltd (EMGF) mine in Wiluna in 1900-01. He reported on a number of mining prospects for the company in the Eastern Goldfields, including the Mt Margaret Goldfield north of Laverton, from 1902 to 1904 and erected the plant for Vivien GMg Co. near Lawlers in 1904. He was manager of the Craiggie more Pty Ltd. gold mine (MMGF) at Laverton when the mine was under option from 1904 to 1906 and worked with J.A. Agnew (q.v.) in Bewick Moreing's agency company, London & Western Australian Exploration Co, on mines being developed in the East Murchison GF in 1907-08. He was manager of the Laverton mine of Lancefield GMg Co Ltd (MMGF Mt Margaret ) in 1908 when he remodelled its plant in an attempt to improve its treatment of the arsenopyrite ore encountered. In 1908-09 he managed Northern Mines Ltd at Lawlers (EMGF) which consisted of a central processing plant at the nearly worked out Great Eastern United mine at Lawlers which was connected by a 19 km long steam tramway to satellite mines. He then travelled to Nicaragua in Central America where he worked until 1912 as the regional manager for Bewick Moreing & Co. and its associated company Oroya Exploration Co. and its Central Nicaragua mine.

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He moved to Britain where he reported on several Welsh copper mining prospects for Bewick Moreing and designed and erected two tin-dressing plants in Cornwall. Because of deteriorating health he stayed in Cornwall supervising tin mines and dressing and dredging plants. He worked in Bewick Moreing's London office in 1914 until returning in 1915 to Western Australia where he established a consulting engineer's business on his own behalf. He examined a proposal to briquette Collie coal which he did not recommend. He took up tin mining leases in Greenbushes and operated three dredging plants there until 1921. Subsequently he was consultant to a number of mines in the Yalgoo and East Murchison Goldfields and continued his practice until the 1930s. He was elected a member of the Institution of Mining and Metallurgy in 1913 and was President of the Mining Association of Western Australia in 1923-27 and in 1933.

WAMBEJ 16 Jan 1909; Reid pp.65-6; Colless p.102; MCER May 1945; Palmer pp.53-60; Skinner 1905; JCMWA 1905-09

**ALLEN**, Robert MA(Cantab), BSc(Lond), MIMM

A graduate of Cambridge and London Universities, Allen was a partner of G.G. Gifford (q.v.) in Graves Gifford & Company in 1896, and metallurgist at the Westralia Mount Morgans Gold Mines Co. Ltd (MMGF, Mt. Morgans) in 1904. In a series of articles in the *Journal of the Chamber of Mines of Western Australia* he described many of the ore treatment plants of major mines in Western Australia which included; Ivanhoe Gold Mine 1905, pp. 294-306; Oroya Brown Hill Gold Mine 1905, pp. 628-36; Associated Northern Gold Mine 1905, pp. 751-58; Sons of Gwalia Gold Mine 1905, pp. 808-17; and Great Boulder Perseverance Gold Mine 1905, pp. 934-43.

WAGFC Jul 1896; JCMWA 1905

**ALLSOP**, Frederick William ABalSM, FCS, FMetSoc (1865-1932)

Born in Auckland, New Zealand and educated at Ballarat High School and the Ballarat School of Mines, Alsop moved to South Africa in ca.1893 where he worked as a metallurgical chemist for the African Gold Recovery Company. He established the first cyanide works in the Spitkop district of the Transvaal and was a foundation member of the South African Metallurgical and Chemical Society. He returned to Victoria in ca.1896 and set up the first cyanide plant at the Ballarat School of Mines. At Tongio West, near Cassilis in Victoria, he established, with his brother, a Siemens and Halske electro-precipitation plant in which gold was precipitated on lead foil. In 1901 he commenced practice as a consulting metallurgist and became vice-president of the Institution of Assayers and Metallurgists of Victoria. After 1905 he moved to Western Australia and established a metallurgical practice in Kalgoorlie, initially, from 1907, with Bertram Howells and from 1910 with David H. Don. The Allsop and Don partnership in 1914 took over the mill formerly operated by Hainault GMs Ltd before that company merged with South Kalgurli GMs Ltd to form South Kalgurli Consolidated GMs Ltd. A loan made to the partners by the Department of Mines for the mill's conversion to a public battery was repaid in 1916. Allsop was a Kalgoorlie town councillor in 1917 and a municipal councillor from November 1921 until November 1927, during which time he was the Mayor of Kalgoorlie from 1922 to 1927. He was Western Australian National Party MLC for the North-East Province from May 1930 to September 1932.

Clark pp. 317-18; Battye 2, p.896; RDM 1914 p.70, 1916 p.47; MER June 1918, p.285; KM 10 Sep 1932; Reid pp.110-11; DWAE 5; Black and Bolton 2

**ANDERSON**, Ralph Argyle AMAusIMM, AMIMM, MIMS. (c.1880-1932)

After working as a timberman and engine driver in 1896, Anderson joined Charles Grant to work as a 'mining agent and accountant' in Ravensthorpe in 1904. He was manager of the Elverdton: Phillips River Gold and Copper Co Ltd (PRGF

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Mount Desmond) and then secretary of the Flag Gold and Copper Mg Co Ltd (PRGF Kundip). After war service, he worked as a mine surveyor at Youanmi (EMGF, Black Range) in 1916 and then at Collie in 1921, where he was instrumental in having the Coal Mines Regulation Act amended to permit mine surveyors to certify plans of coal mines. He was manager of the Surprise Lead Mine in 1925 and of the Two Boys Lead Mine on the Northampton Mineral Field for the Fremantle Trading Company in 1926, and then of the Gnow's Nest Gold Mine Ltd at Messengers Patch (YaGF) in 1928. He supported C. de Bernales (q.v.) in seeking a bonus on increased production of gold, and was the underground manager of the Lake View and Star Mine (ECGF Boulder) during its extensive redevelopment under J.V. Thorn (q.v.) in 1930.

*WAMBEJ* 12 Jan 1907; *TIMM* 42, 1922, p.605; *RDM* 1925, p.74; *ProcAusIMM* 87, 1932, clvi; M.K. Quartermaine, pers. com. 1991; *ArcAusMM*

### **ARCHIBALD, John Wilson** MAusIME

In 1896-97 Archibald was the general manager and consulting engineer of the Hit or Miss GM (CGF) at Coolgardie, and to Lady Evelyn GMs Ltd (BAGF, Cashman's), which produced 1,883 fine oz of gold in 1897-00, and also of Mount Malcolm Ms Ltd (MMGF Murrin) which in 1897-04 produced 27 thousand fine oz from 41 thousand tons of ore. He was at Mount Margaret in 1904. His published papers include: 'The economic use of compressed air in the elevation of tailings'.

*ProcAusIME* 8-1 (1902), p.103; *GG* 1895 p.1726, 1897 p.388; *WAGC* 11 July 1896 p.16, 27 Feb 1897 p.23; Skinner 1897, 1899

### **ASH, Russel Beresford** ARSM, AMIMM (c.1894-1940)

Ash studied at the Royal School of Mines in England between 1911 and 1914 and served in the Royal Engineers during World War I after which he completed his studies in 1918-19. From 1920 he worked in Ireland at the Allihies Copper Mine and then in Nigeria. He moved to Canada to work at the Great Porcupine mine and then, in 1934, to Western Australia where he joined the Great Boulder Proprietary Ltd (ECGF Boulder) in which he was underground manager at the time of his death.

Skinner 1920; *MCER* May 1940, p.298

### **ATWATER, R.M.**

Atwater joined Bewick Moreing and Company, mining consultants and mine managers, from the USA in c.1898. He worked initially as an inspecting engineer reporting on mining prospects. In 1900-01 he was manager of the Sons of Gwalia Ltd mine near Leonora (MMGF Mt Malcolm) as successor to H.C. Hoover (May 1898), R.H. James (Nov 1898) and E.C. Homersham (1899). In 1901-02 he was manager of the mine of Long Reef Gold Mining Co. Ltd at Lennonsville (MGF Mt Magnet) and later, in 1902, he was sent by BMC to examine a mining prospect in Egypt. In 1932, when Atwater was a mining consultant in New York and Hoover was President of the USA, Atwater wrote to Hoover's supporters correcting lies written about Bewick Moreing and Hoover in Australia in an anti-Hoover book by Hamill.

*JCMWA* 1901; Theil p.321; L.Hoover diary 1902, Hoover Pres. Library, Iowa

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### B

#### **BAKER**, Harold Julian

Baker managed Champion Pty. Ltd from 1901 to the end of 1904, and Cosmopolitan Pty from 1901 to October 1902, when Bewick Moreing & Co. took over its management. Both companies had mines at Kookynie (NCGF). He was attorney of the Gold Finance Company (1901-04), the Colonial Consolidated Finance Corporation (1901-05) and Hannan's Water and Ore Reduction Company in 1904. He was general manager of Malcolm Mines (MMGF, Mt Morgans). in 1905.

*JCMWA* 1902, 1904; Skinner 1905

#### **BALLARD**, Robert JP

Ballard was the manager of the Menzies Mining and Exploration Corporation Ltd (NCGF) from 1897 to 1901 during which time the mine produced 26 thousand fine oz of gold at a valuable grade of 23 dwt per ton. He was the company's consulting engineer from 1898 to 1901. He was also manager of a less successful mine, Central Menzies GM Ltd, in 1899-1900. Lake Ballard is believed to have been named after him.

Skinner 1897, 1900; *JCMWA* 1902

#### **BANKS**, Robert AWASM

Banks was the fourth student to graduate from the WA School of Mines in Kalgoorlie, obtaining a diploma in metallurgy (September 1912) and a mine surveyor's certificate (1911). He was working as a survey assistant at Southern Cross in 1915 when he enlisted in the AIF. After the war he was a surveyor during the Hampton Plains boom in the early 1920s. He was at the Ivanhoe Gold Corporation in 1925 and was chief surveyor at the Lake View and Star in 1929 (both ECGF Boulder). He was in Carbine (CGF Kunanalling) in 1942-3.

RDM 1909, 1915, 1920

#### **BARTON**, B.V.

A mining engineer employed by Bewick Moreing and Co., Barton represented Oroya Brownhill Co. Ltd (ECGF, Boulder) on the Chamber of Mines in 1908 and 1909. He was elected a member of the Australasian Institute of Mining Engineers in 1910 and in 1912 was manager for Bewick Moreing of the Broken Hill South Blocks Co. mine at Broken Hill.

*JCMWA* 1908, 1909; AusIME 1912; Skinner 1912

#### **BARTON**, William Wickstead

Barton was manager of a mine in Mount Magnet in 1897 when he gave evidence to the Royal Commission into Mining. He joined Bewick Moreing and Company in 1899 and was manager of Long Reef GMC (MGF Lennonville) until November 1902. He then managed Great Boulder Main Reef GM (ECGF Boulder) until March 1906, except for a period in 1903-04 when he returned to Long Reef for six months prior to the company being wound up. He left Bewick Moreing in 1906. Barton gave evidence to the Royal Commission on Ventilation and Sanitation in Mines in 1905 on the use of a spray containing sulphide of iron and sodium chloride to reduce dynamite fumes.

GG 1904 p.23; *JCMWA* 1903, 1905; Skinner 1905

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**BEAUMONT**, Edwin Kerby BCE, MIMechE, MAusIMM (b.1869)

Born at Castlemaine in Victoria where his father had been an early digger on the Forest Creek field, Beaumont was educated at Castlemaine Grammar School and Melbourne University from which he graduated with a degree in civil engineering. He worked as a surveyor in the Department of Lands, Mining and Survey, and then in the Melbourne and Metropolitan Board of Works, for which he surveyed, designed, and supervised the construction of a sewerage reticulation scheme to serve the City of Carlton in 1894-96. In 1896 he joined the staff of the Sulphide Corporation's Central Mine at Broken Hill where he gained his mine manager's certificate in 1901, and was appointed underground manager of the mine in 1904. Shortly afterwards, he moved to Western Australia to join Bewick Moreing and Company, for whom he worked as engineer and surveyor at the Oroya-Brownhill Company mine (ECGF, Boulder) until 1907, when he joined the Department of Mines as Inspector of Mines on the Mount Margaret Goldfield. In 1910 he was working as a consultant mining engineer with an office in Perth, and later also one in Kalgoorlie. He was the local manager and representative of Unbehaun & Johnston and of Hoskins & Company between 1910 and 1925. He was chief draughtsman in the drawing office of the Western Australian section of the Trans-Australian Railway during its construction in 1915 and was manager of the Electric Supply Company in 1920. Beaumont was also chief instructor in engineering for Stott's Business and Technical College. He was elected a member of the Australasian Institute of Mining Engineers in 1899 and was returned as a member of the Kalgoorlie Municipal Council in 1912. His published papers include 'Silver lead ore mining and various systems of stoping and timbering employed in Broken Hill NSW', *TAusIME* 9-1 (1903), pp117-44.

Clark p.361; GG 1907, p.1757; RDM 1908; Battye 2, pp.884-5; WArg 10 Feb.1920; MCER Nov 1939; ArcAusMM

**BEDLINGTON**, William David JP. (b.1851)

Born at Merthyr Tydvil in South Wales, where his father was a mining engineer, Bedlington began work in a mine in 1867 and in 1872 was reported to be a colliery manager. In 1886 he emigrated to New South Wales where he managed several collieries near Newcastle. He moved to Western Australia in 1896 and floated the West Collie Coal and Fireclay Company. He was manager of the Collie Co-operative Company's colliery, where he introduced Jeffrey mechanical coal cutters in 1904. He leased the Moira mine (also known as the Government mine) from 1906 to 1911, and was associated with the Collie Proprietary Coal Fields of WA Ltd in 1909, and the Collie Coal Proprietary Ltd. in 1913. He was a member of Collie Municipal Council in 1901, and gave evidence to the Select Committees on the Coal Mines Regulation Bill and on Stimulating the Coal Mining Industry in 1901, and to the Royal Commission on the Collie Coal Field in 1905.

Battye 2, pp.27-28; Skinner 1903, 1909; Stedman p.205

**BEECH**, Harold MAusIMM. (1882-1924)

Born in England at Audley, Staffordshire, Beech worked in the Staffordshire coal mines and was under-head mechanic at Cardiff Navigation and Meiros Gas Coal Collieries in Glamorgan in South Wales between 1896 and 1904 when he emigrated to Western Australia. After studying steam and electrical engineering at the WA School of Mines in Kalgoorlie, he became assistant electrical engineer at the Sons of Gwalia Ltd (MMGF, Leonora) in 1906 and its chief engineer in 1911. To generate electricity for the mine he installed producer gas engines which were fired by local mulga wood. When acting manager of the mine in 1921 he led the fight against a fire which severely damaged the mine's engine room. However, he managed to save the slimes treatment plant, which remained in operation while the rest of the plant was rebuilt. He was elected a member of the Australasian Institute of Mining Engineers in 1918.

JCMWA 1916, 1920; ProcAusIMM 55, 1924, Lxxvi; Reid; ArcAusMM

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### **BEECH**, Solomon (Samuel) James AWASM

Beech became the first student to graduate from the WA School of Mines when he obtained a diploma in metallurgy in December 1907. He was metallurgist at the Sons of Gwalia Ltd (MMGF, Leonora) in 1911-13.

*JCMWA* 1912, 1913; WASM Grads 1977

### **BEGELHOLE**, William J.

In 1894-95 Begelhole was manager of the McCullough GM and of the Empress of Coolgardie GM both at Coolgardie, and was also the attorney for Bayley's West Extended and the Great Coolgardie GMs. In July 1894 it was reported in Perth that he had bought a rich prospect at Londonderry (later known as the Golden Hole) for £50 000, but this was later denied by the prospectors who had pegged the claim. The prospect was subsequently bought by a syndicate led by the Earl of Fingall for £180 000. Begelhole was manager of the Gold Exploration Company of Western Australia in August 1895.

GG 1895 pp.256, 376, 857; Sprake p.25; *W.Argus* 29 Aug.1895; *W.Mail* 7 July 1894; *CM* 21 July 1894

### **BELL**, John Benny MAusIMM. (d.1943)

Bell worked at the Cassilis Mine in Victoria before joining Bewick Moreing and Company in Western Australia in 1909. He worked as an underground sampler and in the processing plant at Great Fingall Consolidated (MGF Day Dawn) and other mines, and, from 1912, was manager of a treatment plant. Leaving Bewick Moreing, he became underground manager at Edna May GM Co. at Westonia (YIGF) in 1916, and joined North Fingall (MGF Day Dawn) in 1921, and Lalla Rookh GM (PGF Marble Bar) in 1922. He was manager of Yalgoo GM (YaGF Yalgoo) in 1925 and worked as an underground manager in Kalgoorlie in the 1930s. Bell became manager of Gold Mines of Kalgoorlie (ECGF Boulder) in 1937, and was subsequently the company's acting Western Australian superintendent until succeeded by F.F. Espie (q.v.) in 1943. He was elected a member of the Australasian Institute of Mining and Metallurgy in 1938.

*ProcAusIMM* 129, 1943, X xvi; *CMWA* 1939, 1944; L.Clark pp.68, 96

### **BELL**, Willoughby George BSc, ASASM, MAusIMM (c.1877-1918)

A graduate of both the University of Adelaide (BSc) and the SA School of Mines (associateships in mining and metallurgy), Bell worked as metallurgist at the Craiggimore Pty mine (MMGF, Mount Margaret) at Laverton, and then at the Golden Pole G Ms (NCGF Ularring) at Davyhurst. He was manager of Croesus Pty (ECGF Kalgoorlie) and then in 1908, when Oroya Links held the lease, he may have managed it under a tribute agreement. He was the manager of Croesus South GMs (ECGF Kalgoorlie) under F.B. Trude (q.v.) in 1911. He was elected a member of the Australasian Institute of Mining Engineers in 1909. He enlisted in the AIF, and died on active service.

*ProcAusIMM* 30, 1918, Lxxvii; *ArcAusMM*

### **BERESFORD**, George Stuart de la Poer

Educated in Adelaide, Beresford was assayer at the Sons of Gwalia Ltd near Leonora and at North Star GM at Malcolm (both MMGF) in 1897 when they were owned by the London & Westralian Mines & Finance Agency under the local control of G.W. Hall (q.v.), and managed by A.W. Castle (q.v.). When the former mine was purchased by Bewick Moreing's agency company, London and Western Australian Exploration Co. Ltd, Beresford moved with Castle to a nearby prospect the Star of Gwalia. When this company folded in 1898, Beresford was appointed assayer and metallurgist at Euro Gold Mines Ltd (MMGF Mt Margaret) which held a series of leases pegged by Hall near Laverton. In its six years of operation from 1898

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the mine produced 18,803 oz of gold. Beresford was manager of Burbanks Birthday Gift (CGF) at Burbanks near Coolgardie in an attempt to revive the mine in 1912 and was at the Golden Butterfly GM Co. (NCGF Yerilla) in 1912-13. Subsequently he was manager of Sand Queen GM Ltd (NCGF Menzies) which from 1910-1920 produced 102 thousand fine oz of gold.

In 1914 Westralia Mt Morgans GMs NL revived the Mt Morgans mine (MMGF Mt Morgans) which had been one of the largest producers in the state during the early 1900s. Beresford became its manager in 1917 a post he held for 20 years under that company and under two subsequent lease holders, the Recovery Syndicate and Westralia Renown NL. Throughout that period a limited single shift produced an average of 3-4,000 ounces a year at an average grade of 5.8 dwt per ton. Beresford retired in 1936.

*JCMWA* 1911, 1912; Battye Library OH; Chase & Krantz pp.38-47

### **BIGELOW**, David Edgar

A Californian recruited to Bewick Moreing and Company by H.C. Hoover (q.v.), Bigelow managed Lake View Consols Ltd. (ECGF Boulder) in 1902-04, Oroya Brownhill Company (ECGF Boulder) in 1904-05, Bellevue Consolidated Ltd (EMGF Lawlers) at Sir Samuel in 1905 and Lancefield Gold Mining Co (MMGF Mt Margaret) at Laverton in 1906. He also acted as Bewick Moreing's chief mechanical engineer in Western Australia and gave evidence to the Royal Commission on Ventilation and Sanitation of Mines in 1904. While at Lake View Consols he invented two significant improvements to the commonly used Blake rock breaker, a machine in which ore was broken between a fixed vertical plate and a hanging jaw plate. Bigelow cured the two main weaknesses in the machine. The operating mechanism was strengthened and a safety device was added which prevented an unbreakable object from damaging the machinery. (WA patent 4787 of 1904 and Commonwealth patent 4571 of 1905 which was renewed in 1912). By 1906 at least four mines on the Golden Mile had adopted the Bigelow breaker. He also took out patents for 'a pulp washing and filtering machine' (WA patent 4792 of 1904). He left Western Australia to work for Bewick Moreing at the South Blocks mine at Broken Hill in 1907. Bigelow was elected a member of the Australasian Institute of Mining Engineers in 1910 and returned to the USA in 1911. He was a mining engineering consultant in Berkeley, California in 1912.

Skinner 1904; *JCMWA* 1903, 1904, 1905; Truscott pp.36-50; Patent Register of W.G. Manners

### **BIRKBECK**, Thomas Broughton

Birkbeck arrived in Western Australia in 1898 as an inspecting engineer for an investment syndicate. In 1899 with H. Hoffman (q.v.) he formed Birkbeck, Hoffman & Company, consulting engineers and mine managers. In 1900, W.H. Jowett (q.v.) joined the partnership which became Birkbeck, Hoffman & Jowett & Company. On behalf of the latter company Birkbeck managed Mount Margaret Reward Claim Ltd (MMGF Mt Morgans) at Mt Margaret in 1901-02, the Lady Loch Gold Mine Ltd (CGF Coolgardie) in 1901-04, and Potosi Consolidated Ltd (MMGF Mt Morgans) at Yundamindera in 1904-07. He was on the executive council of the Chamber of Mines of Western Australia in 1904 and 1905.

*WAGFC* 19 Nov.1896, 12 Feb.1898; *JCMWA* 1902, 1907; Skinner 1900

### **BISSENBARGER**, Frank X., FRGS. (b. 1852)

A prospector and mining engineer, Bissenbarger was born in Hungary and came to South Australia in 1875 where he formed a number of mining companies. He moved to Western Australia where he sought suitable leases to develop with a syndicate. In 1893 he arrived at White Feather (Kanowna) where he pegged four 12 acre leases on the line of the reef which passed through McAuliffe's Reward. In December 1894 a company, White Feather Main Reef GMg Co, was formed

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which purchased two of Bissenberger's leases and, in April 1895, it purchased the other two. This company's mine became the most profitable one in Kanowna. Bissenberger was manager of the Nil Desperandum mine (NECGF Kanowna) in 1895, and of Kanowna Pty Ltd. (NECGF Kanowna) in 1896. He was a foundation member of the Kalgoorlie Chamber of Mines in 1896.

WAGFC 15 Sept 1894, 5 Oct 1894; WArg 26 Sept 1895; Skinner 1897; Bull p.16; Gervas p.22

**BISSET**, Laurence Percival MAusIMM. (c.1880-1959)

Bisset studied at the Bendigo School of Mines between 1895 and 1898, and in 1900 was appointed assayer and cyanide plant assistant manager at Birthday GM Company at Berringa, Victoria. He was assayer at the Griffiths GM Company in Coolgardie in 1901, and subsequently metallurgist at the Challenge GM Company at Niagara (NCGF). After sampling and reporting on properties for the Cosmopolitan Syndicate at Kookynie (NCGF) in 1901, he managed the Tampa Cyanide Works (NCGF Niagara) and in 1902 became assayer and manager of the tailings plant at the W.E.G. Gold Mine at Jessop (NCGF Niagara). Bisset joined the Department of Mines in 1903 as assayer for the state batteries at Darlot, Mulline, Menzies and Leonora and in 1905 he became manager of all four batteries. He was stationed at Burtville in 1911 and during World War 1 was seconded to the Department of Civil Defence, working on the supply of strategic minerals in the office of the Under-Secretary for Mines. He was in Coolgardie in 1925 and was manager of the batteries at Meekathara and Peak Hill in 1929. He moved to Perth in 1932, and was on the permanent staff of the Department of Mines in 1934. He retired in 1945 when he was Inspector of State Batteries. Bisset was elected a member of the Australasian Institute of Mining and Metallurgy in 1926.

RDM 1932, 1945; *ProcAusIMM* 85, 1932, Xxvi; *ArcAusMM*

**BLACK**, Robert Silvers MAusIMM, MAIME. (1860-1934)

Born at Milton in the South Island of New Zealand, Black joined the National Bank in 1884 and worked in its assay office at Reefton mining centre, and then as manager of its branch at Timaru in 1885. He resigned from the bank in 1890 and then worked as a mine manager on the silver field at Zeehan in Tasmania for five years. In February 1895, while in Melbourne, Black was appointed general manager of the Londonderry Gold Mine Ltd (CGF Londonderry) by its managing director in Australia, R.G. Casey. This company had been floated in London by the Earl of Fingall's syndicate after its purchase of a reputedly very rich surface deposit near Coolgardie, the Londonderry 'Golden Hole'. Black supervised the opening up of the 'Golden Hole' at the end of March 1895 when it was discovered that almost all of the deposit's rich ore had been removed by its prospector finders before its purchase by Fingall. Black remained general manager of the Londonderry mine until 1900, and of Fingall's exploration company, Australia United Mining Co., until 1901. The latter paid a single dividend in 1898 from the operation of a mine in the Mt Margaret goldfield. The Londonderry GM Ltd was reconstructed in 1901 and operated until 1904. It produced over ten thousand ounces but never paid a dividend. By 1898 Black was only working part time at Londonderry as he was also manager of the Octagon group of mines at Menzies. He may also have managed the Kalgurli United mine (ECGF, Kalgoorlie). He was appointed manager of Kalgurli Gold Mines (ECGF Boulder) and Hainault Gold Mine Ltd (ECGF Boulder) in April 1900, and also managed Britannia Gold Mining Co (Broad Arrow GF) in 1901-02. In August 1902 he resigned from his mining posts due to ill health and returned to New Zealand to manage his family's pastoral interests. He resumed the management of Kalgurli Gold Mines and Hainault Gold Mine in 1908. He managed the Hainault mine until 1913 when the company was amalgamated with South Kalgurli GM Ltd. Black was manager of Kalgurli GMs until 1921, when he purchased a sheep station at Sandstone in partnership with his



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son and retired from mining. He was elected a member of the Australasian Institute of Mining Engineers in 1909, and was its president in 1917. He was a vice-president of the Chamber of Mines of Western Australia from 1908.

WAGFC 1 Sept.1896; WArg 26 April 1900, 30 Sept.1902; Skinner 1897, 1902; GG 1900 pp.437-38; JCMWA 1902, 1903; Battye 2, p.347; JCMWA 1908; Skinner 1920; Reid pp.254, 288. WestA 31 Mar.1934; Gibney & Smith 1, p.62. Sprake pp.113-20; ArcAusMM

**BLACKETT**, Charles Edward MAusIMM, MIMM. (d.1964)

Blackett worked for two years in the laboratory of the Government Analyst in Victoria and then as an assistant chemist in Broken Hill. In 1900 he was appointed chief chemist of the Golden Horseshoe Estates Company Ltd. (ECGF Boulder) and became metallurgist of that company in 1903. He was consultant metallurgist to Craiggimore Pty Ltd at Laverton (MMGF Laverton) in 1904 when he gave evidence to the Royal Commission on the Ventilation and Sanitation of Mines. He remained at Golden Horseshoe Estates until its closure in 1928, and its subsequent amalgamation with Lake View and Star. He was appointed metallurgist to Boulder Perseverance (ECGF Boulder) in 1929, and succeeded E. Williams (q.v.) as its general manager in 1931. He worked as a consultant to a number of mines during the latter part of the 1930s including the New Occidental Mine at Cobar in New South Wales and was consultant to the Lancefield Gold Mine (MMGF Laverton) in 1955. Blackett was elected a member of the Australasian Institute of Mining Engineers in 1909, and of the Institution of Mining and Metallurgy in 1911. He served as a councilor of the Australasian Institute of Mining and Metallurgy between 1940 and 1964, and was elected a senior member in 1950.

His published papers include 'Zinc precipitation and clean up at the Golden Horseshoe Estate' *JCMWA* 18, 1919, pp.130-31; 'Cyanidisation then flotation' *MER* Feb.1936, pp.113-14; 'Blast hole diamond drilling ... at New Occidental Gold Mine NL Cobar' *ProcAusIMM* 142, p.151.

*JCMWA* 1908, 1920; *MYBA* 1940 p.222, 1955 p.241; ArcAusMM

**BLATCHFORD**, Torrington BA, MAusIMM (1869-1938)

Educated at Sydney University where he obtained a BA and attended classes in mining engineering, Blatchford was appointed field geologist in the Geological Survey of Western Australia and served as assistant geologist from March 1897 to June 1900. During this time he wrote 'Geology of the Coolgardie Goldfield' *BGSWA* 3, 1899, 'The Phillips River Goldfield' *BGSWA* 4, 1899, and 'The Phillips River Mining District' *BGSWA* 5, 1900. After resigning from the Geological Survey on 31 May 1900 he worked on the metallurgical staff of the Ivanhoe Gold Corporation (ECGF Boulder) during the development of the mine's sulpho-telluride ore processing plant. He worked until 1904 with R.A. Black, A.E. Thomas and F.B. Powell (qq.v) in a partnership providing metallurgical and engineering services. In 1906 he joined with H.E. Whitfeld and G.F. Young (qq.v), who had both also worked at the Ivanhoe processing plant, to retreat a large slimes dump at the Lady Robinson mine at Burbanks (CGF Coolgardie) using filter presses. In 1908, with Black and F. de J. Grut, he formed the company, Black, Blatchford and Grut (q.v), metallurgists and engineers, which operated until March 1911, when Blatchford rejoined the Geological Survey as a field geologist. In 1919 he reported with Whitfeld (by then Professor of Mining at the University of Western Australia) on the problems of water in the Edna May group of mines at Westonia. Blatchford then served as Assistant State Mining Engineer under A. Montgomery to 1921, when he was seconded to Fresney Kimberley Oil Company to evaluate the petroleum potential of the Fitzroy Basin. He again became Assistant State Geologist in 1924 and, when A.G. Maitland retired in November 1926, Blatchford succeeded him as Government Geologist. He held that position until his retirement in 1934. He was consultant to the Comet Gold Mine at Marble Bar (PGF) in 1936.

His other publications include 'Geological investigations ... Burbanks and Londonderry Mining Centres ... ore deposits and their future prospects' *BGSWA* 47, 1912; and, with T. Jutson, 'Mining geology of the Kanowna Main Reefs line, ... North East Coolgardie Goldfield' *BGSWA* 47, 1912; 'The Whim Well copper mine, WA', *CEMR* v.14, Oct 1921, p.5-6, 41.

**BLOXSOME**, Oswald Lloyd

Warg 5 July 1900: JCMWA 1902-1920: Skinner 1897, 1902, 1903, 1904, 1915, 1920: Reid p.272

**BLYTH, William Birch** ABalSM, AMIMM, AMCMSSA, AMAusIME (c.1880-1944)

His papers include: 'Notes on the softening of feed water ... steam boilers' *JCMWA* 1907, pp.617-20; 'The preparation of samples for assay' *JCMWA* 1912, pp.155-160; 'The consulting metallurgist and metallurgical investigations at the Great Fingall Day Dawn' *ProcAusIMM* NS16, 1914, pp.403-38; 'Hardness of ores' *JCMWA* 1914, 13, pp.88-90; 'Treatment of slimes on the small gold mines of Rhodesia' *TIMM* 46, 1936, pp.613-36; with W.R. Degenhardt (q.v.) 'Yuanmi Gold Mine, description and operation of mill' *JCMWA* 11, 1912, pp.255-63.

*JCMWA* 1914; *MER* June 1915, June 1917; *TIMM* 54, 1944, p.259

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### **BORROWE**, George Walkem

Borrowe was born in Sidka, Alaska, and gained his early experience in mining at Bodie in California, and in Mexico. He went to South Africa in the mid-1890s and became manager of Riet Kuil Mines, one of the Johannesburg deep level mines. During the Boer War he moved to Bulawayo in Southern Rhodesia, where, in 1902, he was consulting engineer to Bechuanaland Exploration Co. and Selukwe Gold Mining Co. He returned to the USA and was recruited by Herbert Hoover to work for Bewick Moreing in WA where, in 1904-05, Borrowe was superintendent of the Sons of Gwalia Ltd near Leonora (MMGF Mt Malcolm). He gave evidence to the Royal Commission on the Ventilation and Sanitation of Mines in September 1904. In 1906-08 he managed Great Boulder Perseverance GM Co. (ECGF Boulder) on behalf of Hooper, Speak & Co., the company's general manager and engineering consultant.

*JCMWA* 1907-08; Williams, *American Engineers in South Africa*, 1902, p.4

### **BRETT**, Henry Tyndall MAusIMM, MIMM. (c.1876-1938)

Brett worked at the Kinsella mine at Day Dawn (MGF) in 1894. After attending classes at the Melbourne Analytical Laboratory in 1897, he was appointed assayer at the Ivanhoe Gold Corporation (ECGF Boulder) in 1898, and the mine's reduction officer in 1900. He gave evidence to the Royal Commission on the Ventilation and Sanitation of Mines in 1904. In 1906 he moved to Rhodesia to become manager of the Sabiwa Central mine and established a practice as a mining engineer and consultant metallurgist in Bulawayo in 1908. He was manager of the Falcon Mine of Falcon (Rhodesia) Development Co. Ltd between 1915 and 1920. He was one of several owners of an Australian Patent for 'underground signalling for mines' which was registered in 1903. He was elected a member of the Australasian Institute of Mining Engineers in 1912.

His published papers include: 'Experiments with new Wilfley slime concentrator at Ivanhoe Gold Corporation', *JCMWA* 1905, p.75; 'Treatment of concentrates at Ivanhoe Mine', *JCMWA* 1905, pp.818-22; 'Cyanide practice at Kalgoorlie' *WAMBEJ* 16 Feb.1906, pp.8-9.

*JCMWA* 1906; *WAMBEJ* 14 April 1906, 27 Nov. 1909; Skinner 1915, 1920; *TIMM* 48, 1938, p.827; ArcAusMM

### **BRIGGS**, Thomas Davy (b.1860)

After working in the coal mines of South Yorkshire for about eleven years, he was a mine manger in Victoria for five years, and in New South Wales for seven years. He then worked for five years on the goldfields of Western Australia. He was the Inspector of Mines on the Collie Coalfield from 1899 to 1910 and, in 1913, was appointed manager of the Collie mine operated by Proprietary Coal Mines of Western Australia. He was manager of the Proprietary, the Collie and the Scottish collieries at Collie in 1920, and participated in the formation of the Amalgamated Colliery in the same year.

RPCA 1913, p.200; RDM 1902 p.62, 1912 p.33; PSL 1910

### **BRIMAGE**, Thomas Frederick Outridge MLC, JP (1866-1915)

Born in London, Brimage emigrated to South Australia with his parents. He served an apprenticeship in the Islington Workshops of the South Australian Railways which he left as a draughtsman, in 1894, to move to Western Australia where he worked at Bayley's Mine in Coolgardie. He established a business as a consulting engineer in Coolgardie in 1894 and as a land agent and stock broker in Kalgoorlie in 1895, a practice which was extended to Perth in 1900. He was a vice-president of the Mine Manager's Association of Western Australia, and a director of the Kalgoorlie Prospecting and Gold Mining Company. He was a principal of T.F. Brimage and Company, a carting contractor. He was a member of the East

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Coolgardie (later Kalgoorlie) Roads Board in 1896-99 and was its chairman in 1899. He was a member of the WA Legislative Council for the South Province (1900-06) and for the North-East Province (1906-12).

WArg 28 Nov.1895, 30 July 1896, 30 Aug.1900; Battye 1, pp.334-35; WA 27 May 1915; Kimberly, pp.208-09; Reid pp.133-37; Black & Bolton p.36

**BRINSDEN**, Frederick George ABalSM, MIMM, MAusIMM (1880-1958)

Born in Victoria at Kingston near Ballarat and educated at Creswick Grammar School and the Ballarat School of Mines, Brinsden joined Kalgurli GMs Ltd (ECGF Boulder) as metallurgist and mill superintendent in 1905. In 1907 he became manager of Hainault GM Ltd (ECGF Boulder). However, when R.S. Black (q.v.) returned to Kalgoorlie in 1908 to become manager of both Kalgurli Gold Mines and Hainault GM, Brinsden returned to Kalgurli GMs in his former position. He retained this until 1920, when he was appointed general manager of South Kalgurli Consolidated Ltd. He served in this position until he retired in 1948 and remained the company's consultant until 1951. Brinsden is generally recognised as having initiated the research done in the 1920s by the Metallurgical Laboratory of the WA School of Mines into the use of flotation in the treatment of Kalgoorlie sulpho-telluride ore, which was an important factor in the revival of the Kalgoorlie mines in the 1930s. He gave evidence to the Royal Commissions on Miners' Lung Disease in 1911 and on Mining in 1925. Brinsden was vice-president of the Chamber of Mines of WA in 1942, its President between 1943 and 1949 and subsequently one of its life members. He was a member of the State Committee of the CSIRO, and of the Advisory Panel for Secondary Industry in 1945. He was a director of North Kalgoorlie GMG NL in 1950, of New Coolgardie GMs in 1953, and of Western Collieries in 1951-1955. He was elected a member of the Australasian Institute of Mining and Metallurgy in 1909 (then known as the Australasian Institute of Mining Engineers), and was the Institute's President in 1933. He received its medal in 1947 for his contributions to the metallurgical treatment of sulpho-telluride ores, and for his services in securing continuity, stability and harmonious industrial relations in the mining industry of Western Australia.

His published papers include: 'Roasting sulpho-telluride ores at the Kalgurli Gold Mine Ltd.' *TAusIME* XV, pp.77-81; 'Wood stave pipe' *JCMWA* 11, 1912, p.328; 'Presidential address' *TAusIMM* 91, 1933, p.255; 'The Gold Industry, the need for Federal Aid stressed' *WAMCR* June 1949.

*JCMWA* 1908, 1920; Ferguson p.134; *MCER* July 1945; *MYBA* 1940; *MIYBA* 1953; 'Obit' *KM* 26 June 1958; Gibney/Smith 1, p.83; *ArcAusMM*

**BROADBRIDGE**, Walter MIMM, AMICE (1860-1946)

Broadbridge worked in South Africa and Sumatra before joining Bewick Moreing and Company in 1902 as manager of the Sons of Gwalia Ltd (MMGF Leonora). He was the manager for Bewick Moreing of Vivien GM Company near Lawlers (EMGF) in 1904, shortly after the mine had been acquired by Bewick Moreing's agency company London & Western Australian Exploration Co. He subsequently returned to England where he was first consultant to, and then, chief engineer of, Minerals Separation Ltd, from 1915 to 1920, when he played an important role in the widespread adoption of the flotation process of which the company held the key patents. Broadbridge was a director of the Boulder Perseverance Gold Mine from 1923 until the 1940s.

His papers include: 'Froth flotation; its commercial application and its influence on modern concentration and smelting practice' *TIMM* 29, 1919, pp.205-77.

*JCMWA* 1904; Skinner 1904, 1915, 1920; *Bulletin IMM*, 48

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**BROWNE**, Desmond (Mark) Freeman Valentine ABaiSM, MIMM, MAusIMM (1884-1959)

Mark Browne graduated from the Bairnsdale School of Mines (Victoria) when he was awarded the School's Gold Medal and a diploma in metallurgy. He joined the WA Department of Mines as assayer at the Mulline state battery (NCGF Ularring) in 1904, and became manager of the state batteries at Pinjin (NCGF Yerilla) in 1907 and at Yarri (NCGF Yerilla) in 1912. In 1928 Browne was appointed Inspector of State Batteries and, in 1931, Superintendent of State Batteries, a post which he held until his retirement in 1949. He was succeeded as Superintendent by C. F. Adams (q.v.). Browne was elected a member of the Australasian Institute of Mining and Metallurgy in 1927

PSL 1930, 1939, 1945; ArcAusMM; ArcDMWA

**BROWNE**, Gerald M. MIMM, AMICE

Gerald Browne managed several mines in Kalgoorlie-Boulder after 1900: Hannan's Block 45 Ltd (ECGF Boulder) in 1901-02, Kalgurli United GM Co. (ECGF Boulder) in 1901-04, North Boulder GM Co. (ECGF Boulder) in 1902-05, and Croesus Pty GM Co. (ECGF Kalgoorlie) in 1903-04. He also was responsible for the management of a number of other mines outside Kalgoorlie. In 1902-04 one of these, owned by Octagon Explorers Ltd, was near Leonora (MMGF). Others were Mount Ida Consols Ltd at Mt Ida (NCGF Menzies) in 1902-06, Westralia Waihi GM at Davyhurst (NCGF Ularring) in 1903-08, Great Tower Hill GM near Leonora (MMGF) in 1905-08, and, also in 1905-08, New Standard Exploration Co. Ltd which had its principal mine at Dunnsville (CGF Kunanalling). Although it was not unusual for managers to oversee more than one mine, Browne's 'outback' mines in 1905, at Mt Ida, Davyhurst, Leonora and Dunnsville were in widely scattered locations requiring extensive travelling by him or his associates. The majority were producing more than 1,000 oz of gold a year and would have required regular attendance for amalgamation clean-ups. Browne's heavy workload was probably one of the reasons for him forming a partnership with C.B. Kingston (q.v.), Kingston and Browne, mining consultant and manager. The partnership managed Bayley's Consolidated GM Co. at Coolgardie in 1904, Kalgoorlie United Consolidated GM (a reconstruction of Kalgoorlie United GM) in 1905, and Mount Ida GM Co. (NCGF Menzies) in 1905. After the addition of a third partner to form Pearse, Kingston & Browne, the new company was consulting engineer to the Peak Hill Goldfield Ltd. (PHGF) in 1909, shortly before its closure. Browne was in London in 1910, and was engineer and manager of the El Amporo Mine near the border between Bolivia and Venezuela in 1915. In 1905 he registered Commonwealth Patent 3115 for 'distributing vats' which was renewed in 1912.

JCMWA 1902-08, 1919; Skinner 1904, 1905, 1909, 1915; Patent Register of W.G. Manners (1904-25)

**BROWNE**, Thomas Valentine MIMM. (1869-1909)

Thomas Browne was educated in Melbourne in 1889-93, and worked as an assayer at Broken Hill and as an analyst at Port Adelaide. In Western Australia he was employed by Bewick Moreing & Co., including a period as metallurgist at Lake View Consols (ECGF Boulder) in 1902 and one as manager of the Bellevue Proprietary Ltd mine at Mount Sir Samuel (EMGF Lawlers) in 1906-07. He returned to Victoria in 1908 where he worked as a metallurgist in Caulfield. Browne's health was never good and he died in 1909.

WArg 28 Oct.1902; JCMWA 1907; TIMM 20, 1911-2, p.521

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**BUTEMENT**, Thomas AOSM, ME, MAusIMM. (1863-1958)

Butement was educated in New Zealand at Melton High School and Christ's College in Christchurch. He spent two years working in a foundry in Dunedin and studied at Otago School of Mines from which he graduated with certificates in metallurgical chemistry and mine surveying. He worked at the Mount Bischoff tin mine in Tasmania in 1888, at Ravenswood in Queensland in 1889, and at Silver Queen Extension silver mine at Zeehan in Tasmania in 1891. He moved to Western Australia where he worked in Cue in 1894-96 and at Fields Find GM at Yalgoo (YaGF) in 1899- 1902. A foundation member of the Australasian Institute of Mining Engineers in 1893, he joined the Western Australian School of Mines at Kalgoorlie as its assistant director and lecturer in mining engineering in 1903. He carried much of the administrative load of the School after its director, F.B. Allen (q.v.), also became Western Australian Director of Technical Education in 1908. Butement was appointed Acting Principal of the School of Mines in 1929, and when he retired to Kalamunda, in 1930, he was succeeded by B.H. Moore (q.v.). He returned to Bullfinch in 1933 and to Field's Find, Yalgoo, in 1935 to reopen mines, but retired again in 1941. He moved to Melbourne in 1947, and was in Adelaide in 1958.

His papers include: 'Westonia, Western Australia's youngest goldfield' *MER* Dec 1916, pp.54-59;

'Gold mining in W A. I. The present position and outlook of the Kalgoorlie mines', *CEMR* v.10, June 1918, pp.260-64;

'II. The geology of Kalgoorlie', *CEMR* v.10, July 1918, pp.297-301;

'III. Kalgoorlie: the ore bodies – the Oroya shoot', *CEMR* v.10, Aug 1918, pp.328-33;

'IV. Kalgoorlie: Oroya Links, Brownhill Extended, Paringa Mines, Associated Northern Blocks, Kalgurli GMs, New North Boulder GMs, North Kalgurli (1912)', *CEMR* v.10, Sept 1918, pp.364-68;

'V. Kalgoorlie: Associated GMs, South Kalgurli, Great Boulder Perseverance', *CEMR* v.11, Oct 1918, pp.14-18;

'VI. Kalgoorlie: Great Boulder Pty, Ivanhoe Gold Corp, Golden Horseshoe Estates', *CEMR* v.11, Nov 1918, pp.42-47;

'VII. Gold mining in WA and Kalgoorlie [data & comment]', *CEMR* v.11, Jan 1919, pp.107-10;

'The Edna May Mines, WA (pt 1 & pt 2)', *CEMR* v.12, Oct 1919, pp.7-13 & Nov 1919, pp.56-64;

'Hampton Plains goldfield, WA', *CEMR* v.12, May 1920, pp.281-287.

*WArg* 30 Aug.1900; Skinner 1900, 1902; *WAMBEJ* 7 Nov.1903; Matters, p.190; 82 years 1984, *WASM*, p.98; Palmer, pp.13, 28, 65, 92; M.K. Quartermaine, pers. com., 1991

## C

**CALLAHAN**, Henry Clay

Callahan was the American mining engineer who was manager in 1897-1900 of Lake View Consols (ECGF Boulder), then controlled by the promoter and market manipulator, Whitaker Wright. Callahan had previously worked in the Cripple Creek mining field in Colorado which, like Kalgoorlie, was one of the few mining centres to contain the rare sulpho-telluride gold ore. Callahan's first priority in 1897 was to find a method to satisfactorily treat the mine's sulpho-telluride ore as the mine's near-surface oxidised ore had nearly all been mined. Treatment trials using a small Victorian reverberatory furnace roasting dry crushed ore and cyanide leaching of the roast were sufficiently favourable for Callahan to recommend the construction of a sulphide plant on that basis. After further trials in London two straight line reverberatory furnaces were ordered from the USA and the complete plant was ready for tests to begin at the start of 1899. They soon began to run into difficulties, particularly ones affecting the operation of the furnaces which had been designed for firing with coal or gas rather than highly combustible eucalypt wood and the operators were unable to control the furnace temperatures. Inconsistent roasting exacerbated other downstream problems. Improvements came at a snail-like pace mainly because Callahan was

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preoccupied with how to deal with an abundance of very valuable ore at the same time as the company finances were being manipulated by Wright. In 1898 a very valuable lode of ore had been discovered in the mine which proved to be the most valuable deposit ever mined in large quantities in Kalgoorlie-Boulder. Callahan adopted a policy of selectively mining the rich ore as quickly as possible and of sending it by rail and sea for smelting in South Australia. This method of operating was thought to have been ordered by Wright to counteract a 'bear' attack on the company's shares in London. In 1899, 10,328 tons of ore and concentrates from the mine were smelted to produce 163,599 ounces of bullion with an extraordinary average grade of 316.8 dwt per ton. Half way through 1899 the extraction rate of the valuable ore began to slow and Callahan was called to London 'to confer with the company's directors'. When he arrived he mysteriously predicted a continuance of high production rates though he must have known the limitations to the rich ore. Wright's finance company continued to buy further shares in Lake View but as monthly production figures continued to fall Wright resorted to falsifying reports. His company was soon bankrupted having lost millions of pounds.

One of Callahan's last actions before leaving for London was to approve a trial treatment of the mine's sulphotelluride ore using the still un-proven Diehl process, devised by Dr Diehl (q.v.) of the London and Hamburg Company. This process was very similar to the standard cyanide process except that bromocyanide was used in addition to cyanide for treating the finely ground tailings. The trial, which was supervised by Roberts (q.v.), the Lake View metallurgist, took place in January 1900 and was a complete success. Coming after the dramas which Lake View had endured in 1899, the results of the Diehl trial were greeted with great acclaim in Kalgoorlie. However, the results had come too late for Callahan who tendered his resignation in February and disappeared from the Australian mining scene.

WArg 4 Feb1897, 15 Feb1900, 1 Mar1900; RDM 1903 pp.163-73; KL 11 Jan, 16 Jan, 19 Jan, 2 Feb 1900

### **CAMERON, Colin B.**

Although the very rich surface ore of the Londonderry Gold Mine (CGF Londonderry), known as the Golden Hole, was, in 1895, found not to extend to depth, under the management of R.S. Black and G. Aarons (both q.v.) the mine continued to operate until 1903 when the company was liquidated. A second Londonderry GM under the management of Colin Cameron then worked the mine for two years before also closing. Cameron became manager of Croesus South GMs Ltd (ECGF Kalgoorlie) until 1906 when mining work was temporarily suspended and the mine was let to tributers. In October 1906 he was the inaugural manager of Ingliston Extended GMs Ltd (MGF Meekatharra) where in the first two years, 1906-07, 57 thousands of ounces of fine gold were produced.

JCMWA 1903, 1904, 1906, 1907; Skinner 1906; Sprake p.108

### **CAMPBELL, Colin** AOSM, MIMM (1877-1954)

Campbell was a student of Otago University School of Mines, where in March 1901 he obtained the School's associateship diploma with certificates in chemistry and assay work. During 1899-02 he worked in several gold mines in the Auckland district before moving to Western Australia, where he worked in the gold room at Kalgurli GMs (ECGF Kalgoorlie) which was one of the top fifteen gold producers in the state. In 1903 he sampled and reported on Western Australian mining properties and in 1903-04 he was metallurgist and acting manager at Lady Shenton GM Ltd (NCGF Menzies). The mine produced over 20 thousand ounces of bullion each year from 1898 to 1902 but in 1903 production fell to 17 thousand ounces and the mine was closed the following year.

In 1904 Campbell went to South Africa and worked as an assayer and sampler in a number of Transvaal mines. In 1906 he was manager of the Parsons Chromite Syndicate in Johannesburg and in 1907 he managed the prospecting operations

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of New Districts Development Co. Ltd. He went to Southern Rhodesia in 1908 and in 1909 was assistant consulting engineer to Rhodesia Consolidated Ltd and three associated companies. In 1912 he was appointed consulting engineer to Mashonaland Consolidated Ltd and five other companies. During the 1914-18 war he served in India where he was appointed superintending engineer of the Government mica mines. After demobilisation he prospected for oil in Burma and West Africa before moving to England where he established a mining consultancy practice, during the course of which he worked in Spain, Greece and the Gold Coast.

After the outbreak of the Second World War he went to Canada to prospect for bauxite and other strategic minerals. He retired in 1948 and returned to New Zealand in 1952, where he died in 1954, aged 77. He was elected to associate membership of the Institution of Mining and Metallurgy in 1913 and to membership in 1920.

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**CAMPION**, George William MIMM, MAusIMM (c.1870-1948)

Born in England, Campion moved to Queensland in 1888 and to Western Australia in 1892. In 1903-4 he was with Hampton Properties Ltd which leased three blocks of the Hampton Plains Estate, numbered 45 & 50 (ECGF Feysville) and 40 (NECGF Kurnalpi). In the two years to 1904 the company produced 2 thousand ounces of gold mainly from the Hampden Boulder mine on block 50. Between 1905 and 1908 Campion was at Red Hill Westralia GM Ltd (CGF) which had two mines, at Red Hill (1903-06) and at Higginsville (1907-10) which in total, over 8 years, produced 26 thousand ounces of gold. Campion left for South America in 1909, visited Britain in 1911. He then worked on the Gold Coast in West Africa for the next twenty years. He was a director of the Taquah and Obosso Gold Mine in 1928, and retired in 1931. He was elected a member of the Australasian Institute of Mining Engineers in 1901.

*JCMWA* 1903, 1905, 1908; MacGill; *IMM Bulletin* 494, June 1940

**CARR**, T.J.

Carr spent almost twenty years from 1900 in mine management at Norseman when its mines were in their productive early period. He was manager of Cumberland GMCo NL (DGF Norseman), 3 km south of Norseman, from 1904 to 1906 when the mine was producing an average of 3 thousand bullion ounces per year at a yield of 19.8 dwt per ton. From 1906 until 1914 (apart from most of one year, 1908) he was underground manager of Mararoa GMCo NL (DGF) which mined the Mararoa Reef east of Norseman. In every year from 1909 to 1914 the mine produced over 13,000 fine ounces per year which placed it among the top 15 producers in the state. In 1908 he was manager of Princess Royal North GMCo NL (DGF) on the Princess Royal Reef, 8km north of Norseman, during what appears to have been its last year of operation in its early period. From 1914 to 1916 Carr was underground manager of Princess Royal GM Co. NL which was the main mine on the Princess Royal Reef. It was also about to close, but in each year from 1900 to 1904 it had produced over 14,000 fine ounces which had also placed it in the top 15 producers in the state.

*JCMWA* 1903-16, DM stats

**CARROLL**, Hubert Henry MC, MAusIMM (c.1892-1965)

Educated at McKay's Grammar School in Castlemaine and at Gailey's Grammar School in Tasmania, Carroll was elected a student member of the Australasian Institute of Mining Engineers in 1915 while he was a draughtsman and assistant surveyor with the Mount Lyell Mining and Railway Company at Queenstown in western Tasmania. After serving with the 1st Australian Tunnelling Company in France between 1915 and 1918, he rejoined Mount Lyell in 1919. He moved to



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Broken Hill where he was underground superintendent between 1921 and 1925. He was appointed assistant general manager at Wiluna GMs in Western Australia (EMGF) in 1932 and the mine's general manager in 1934. He was a member of the executive council of the Western Australian Chamber of Mines between 1934 and 1946. He left Wiluna in 1948 to return to the eastern states. He was a director of Western Titanium NL (Capel WA) from 1958 onwards, a director of Western Mining Corporation from 1960 onwards, and of Eclipse Mining (MGF Mt Magnet) in 1965.

His published papers include: 'Ventilation and the Kata thermometer' *ProcAusIMM* 46, 1922, pp.103-09; 'Sinking No.7 Shaft at Broken Hill South' *ProcAusIMM* 88, 1932, pp.341-60; 'The handling and sharpening of rock drill steel at Wiluna Mines' *ProcAusIMM* 91, 1933, pp.397-416; 'Capping station on Broken Hill South Ltd.' *ProcAusIMM* 120, 1940, p.807.

Colless p.113; CMWA 1934, 1946; MYBA 1940; IRMYBA 1965; ArcAusMM

### **CASTLE**, Alexander Wilson (1850-1905)

Alexander Castle was born in Scotland where he served an apprenticeship in the metal trades before emigrating to California, where he became a naturalised US citizen in 1879. He worked for Fraser and Chalmers, the mining machinery manufacturers, travelling widely as a machinery erection engineer, within the USA and to other countries including Swaziland and Ecuador. In 1888 he supervised the erection of machinery at a mine in North Wales owned by W. Pritchard Morgan, the MP for Merthyr Tydfil and mining financier. In 1895 Castle arrived in Western Australia to oversee the erection of mining machinery for Fraser and Chalmers at Widgiemooltha (CGF). In 1896 he left Fraser and Chalmers to join George W. Hall (q.v.), Pritchard Morgan's consulting engineer, working for Morgan's agency company, London and Westralian Mines and Finance Agency Ltd. Hall would locate and inspect mining prospects and where they showed promise he would purchase them for the London and Westralian agency company which floated, in London, a new company to work the mine. Castle would establish the infrastructure for the new mine and start it up. Hall and Castle established their headquarters at Malcolm (MMGF) where Hall's first mine was located. Hall prospected a large area covering most of the Mount Margaret and East Murchison Goldfields. At the end of 1896 Hall inspected the Sons of Gwalia mining prospect at Leonora and purchased it from Thomas Tobias, the Coolgardie storekeeper who had 'grub staked' the prospectors who had found the outcrop. Castle was appointed manager and organised the erection of a head frame and stamp battery. Edward Hooper, the Western Australian resident partner of Bewick Moreing and Co., visited the mine and instructed Herbert Hoover, Bewick Moreing's inspecting engineer, to make a thorough inspection of the mine. Hoover reported favourably on it and the firm's agency company, London & Western Australian Exploration, purchased the mine and later sold it to a new company it was floated on the London Stock Exchange. Hoover became Bewick Moreing's first manager of the mine. Castle and most of his staff moved to the Star of Gwalia mine which had been started on one of the leases which Hall had pegged to the south of the Sons of Gwalia. The Star of Gwalia was not a success as the main Sons of Gwalia lode was too deep at the Star of Gwalia to be mined economically. Castle returned to the UK in November 1898. His wife joined him in Malcolm in October 1899.

In 1901 and 1902 Hall inspected mining prospects in the East Murchison Goldfield and in February 1902 he purchased two mines at Wiluna, the Essex and Violet mines. They were jointly floated as Gwalia Consolidated and Castle moved to Wiluna to manage the mines. He fell ill in 1905 and died on a coach between Coolgardie and Wiluna.

Beresford OH Battye; pers comm. Mrs D. Watkins, Nov. 2011

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**CHOMLEY**, William Burgh MAusIMM (b.1876)

After completing a course in metallurgy at the Working Men's College in Melbourne in 1903, Chomley joined Bewick Moreing & Co. working as a smelter and assayer at the Oroya Brown Hill GM (ECGF Boulder) in 1904. In 1907 he was the cyanide foreman at Great Fingall Consolidated Ltd (MGF Day Dawn) and in 1909 he was the metallurgist at the Lake Violet mine (EMGF Lake Way), one of the two mines that made up Gwalia Consolidated Ltd. He was the clean-up foreman at the Lancefield mine (MMGF Laverton) in 1910 and was metallurgist at Northern Mines at Lawlers (EMGF), in 1911-12. Later in 1912 when he was the metallurgist at Oroya Black Range Ltd (EMF Black Range) at Sandstone, the mine was acquired by Yuanmi GMs Ltd. He was at Great Fingall Consolidated again in 1917-18 and was transferred to Broken Hill to work at the Zinc Corporation in 1919-21. He left Bewick Moreing to join Mount Morgan GMCo in Queensland in 1924. However, it was a disastrous year for Mount Morgan. A huge section of the ore body containing much of the underground workings collapsed, a bitter labour dispute and an underground fire presaged the liquidation of the company. Chomley returned to Kalgoorlie in 1925 to join Oroya Links (ECGF Boulder-Kalgoorlie) which had been formed in 1909 as an amalgamation of Oroya Brown Hill, Golden Links and Kalgoorlie Amalgamated (1909). In 1930-34 he was at Associated Gold Mines of Western Australia Ltd (ECGF Boulder) and in 1937 with Consolidated Gold Areas at Hampton Plains (ECGF Feysville and CGF Londonderry). Chomley was elected a member of the Australasian Institute of Mining Engineers in 1912.

His published papers include: 'Sand treatment at Oroya Black Range ... notes on the leaching process' *JCMWA* 12, 1913, pp.335-42; 'Precipitation and smelting at the Great Fingall Consolidated Ltd, Day Dawn' *JCMWA* 16, 1917, pp.154-56; 'A discussion of the decantation plant at the Great Fingall Mine' *JCMWA* 17, 1918, pp.15-19; 'A cyanide problem' *JCMWA* 19, 1920, pp.96-98; 'The price of gold' *Mining & Scientific Press* (USA), 30 Oct 1920.

*JCMWA* 1911, 1918; *MCER* April 1937, Sept 1937; *ArcAusMM*; Kerr pp.175-83

**CLARKE**, William George MAusIME (1878-1941)

Born in Russia at Vyaznizke, where his father, an English engineer, was working, Clarke moved to New Zealand with his parents in 1885. He was educated at Auckland Grammar School and Waihi School of Mines from which he graduated with a first class certificate in assaying (wet and dry) and a government certificate in battery management. He worked for four years as a metallurgist with the Waihi GM Company, and after active service in the Boer War, he moved to Western Australia with his brother in 1902. He worked as an amalgamator at the Childe Harold GM (MMGF, Euro) during its last six months of operation and, then, at Bayley's Consolidated GM (CGF, Coolgardie). He joined Burbanks Main Lode (CGF Burbanks) as metallurgist under Wm Nicholas (q.v.) in 1904, and was elected a member of the Australasian Institute of Mining Engineers in 1910. In 1915, he left Burbanks for Kalgoorlie where he worked as a metallurgist at the Ivanhoe and Perseverance mines until 1928 when he joined the Metallurgical Laboratory of the Western Australian School of Mines as research metallurgist, following the resignation of A.S. Winter (q.v.). Working with B.H. Moore (q.v.), Clarke took part in significant investigations into the treatment of Western Australian ores. Some of the most important involved the adaptation of the flotation process to treat refractory ores in the state. He was a councillor of the Municipality of Kalgoorlie from 1922 to 1926. Clarke's published works include:

'Treatment of Kalgoorlie ore: general discussion', *CEMR* Sept 1939, p.490.

With B.A. Moore: 'Reports on Investigations conducted in the Metallurgical Laboratory'; Bulletin 4, 1929 (9 investigations); Bulletin 5, 1930 (6 investigations); Bulletin 6, 1931 (6 investigations); also the following reprints from KS Met Lab reports (all with B.A. Moore):

'Treatment of Lake View & Star low grade sulphide ore', *CEMR* v22, Jan 1930, pp.324-26;

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'Flotation of antimonial ore from Wiluna', *CEMR* v22, May 1930, pp.294-95;

'Treatment of ore from Leonora Central GM, Leonora and from OK GM, Norseman; Lake Austin Eureka GM, Lake Austin; Spargo's Reward GM, Spargoville and Hill 50 GM, Mt Magnet,' *CEMR* Sept 1935, p.446-52.

1987 Annual Report, Western Australian School of Mines, Kalgoorlie, 1987, p.91; ArcAusMM

**CLAYTON**, Horace Edward BE, MAusIMM (b.c.1889)

Clayton graduated in mining and metallurgy at the University of Sydney in 1909 and after moving to Western Australia worked initially at the Youanmi State Battery (EMGF Black Range) and then joined the Sandstone GM Co. (EMGF Black Range) as assayer in 1910. He was elected an associate member of the Australasian Institute of Mining Engineers in 1912 and a member in 1919. He joined Bewick Moreing & Co and worked as surveyor and underground manager at Great Fingall Consolidated at Day Dawn (ECGF) in 1914 and as surveyor at the Sons of Gwalia Ltd (MMGF Leonora) in 1916. He was with Burma Mines Ltd. at the Bawdwin mine, a large silver-lead-zinc deposit in north-eastern Burma in 1919. After leaving Bewick Moreing he was with Austral Malay Tin Ltd. in Taiping in 1925, and with Southern Siamese Tin Dredging Ltd. in 1934. He was a director of Shaw River Alluvials in 1957 and of Alluvial Gold Ltd. in 1959.

His published papers include 'Isometric mine plans' *ProcAusIMM* 34, 1919, pp.9-18.

*MCER* July 1957; ArcAusMM

**CLELAND**, Elphinstone Davenport (1854-1928)

Born in Adelaide, Cleland worked at Broken Hill in the 1880s for six years, in the last two of which he was manager of Australian Broken Hill Consolidated. After inspecting and reporting on several mines in Tasmania, he was in Coolgardie in 1894-95 where he was attorney of the St George Proprietary Gold Mining Company, the Mount Burgess Gold Mining Company and the Christmas Extended Gold Mining Company. He was at Lindsay's Consolidated (CGF Coolgardie) in 1898 when it yielded 2 224 oz of gold bullion, and at Hannan's Block 45 at Boulder (ECGF) in 1900. In a specimen from this mine was identified as telluride of gold for the first time in Western Australia. Subsequent gold production from Block 45 was poor (107 bullion oz in 1899). In 1901 the mine was amalgamated with four other companies to form Kalgoorlie Amalgamated Ltd. Cleland was general manager of Bayley's Gold Mines Ltd. (CGF) in 1902-04 and manager of the Kalgurli GMs (ECGF Boulder) in 1905-06. He gave evidence to the Royal Commission on Ventilation and Sanitation of Mines in 1904 and to the Royal Commission into Miners' Lung Disease in 1911. He reported on the state battery at Broad Arrow for the Mines Department in 1908, and was the acting Inspector of Mines successively for the Phillips River, Greenbushes and Pilbarra goldfields in 1908-10. He was acting manager of Great Boulder Perseverance GMC Ltd (ECGF Boulder) in 1911 under R.A. Varden (q.v). Cleland became the mining correspondent for several papers including the *Sydney Morning Herald* and the *South Australian Register*. In 1907 and 1908 Cleland wrote 13 articles for the Chamber of Mines which were published in successive issues of *The Monthly Journal of the Chamber of Mines of Western Australia* under the title 'The Development of Gold Mining in Western Australia'. In these Cleland described in a comparative manner all the major elements of the eleven principal gold mines of Western Australia, the nine largest producers in Kalgoorlie-Boulder together with the Sons of Gwalia mine at Leonora and Great Fingall Consolidated mine at Day Dawn. In 1911 the Chamber of Mines published these articles in book form entitled *West Australian Mining Practice: A description of the mining methods followed by the principal gold mines of Western Australia*. Information given in the Journal articles was updated in the book which is a major source of data about Western Australian mining practices in the 1900s. Cleland retired as a member of the WA Chamber of Mines in 1918.

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His other published works includes: 'An improved method of signalling in mines' *JCMWA* 2, 1903, p.397.

GG 1894 pp.556,1295; *WAGFC* 18 Jul1896, 2 Jan1897; Skinner 1900, 1903; *WArg* 15 Feb1900; *JCMWA* 1902, 1918; *WAMBEJ* 31 Mar 1906, 28 Aug 1909; *RDM* 1908, pp.69-74; Gibney/Smith 1, p.129.

**COBBE**, Hervic Nugent Grahame MIMM, MAusIME (d.1953)

After two years of study at an engineering college at Derby in England, Cobbe was for one year an articled pupil of the resident engineer of the London and North Western Railway Company. He worked as a metallurgist in the United States and Canada, and in 1892 travelled to Australia where he prospected for minerals in New South Wales and Victoria. He moved to Western Australia where he worked at the Big Blow Gold Mines Ltd near Coolgardie (ECGF). The managing director of this company, formed in London in 1894, was Albert Frederick Calvert, a prominent English advocate of mining in Western Australia and editor and publisher of the weekly *West Australian Mining Register*. The mine on the Big Blow leases was a failure, producing in five years only 861 oz bullion from 3093 tons of ore, and was closed in 1899. Cobbe was elected a member of the Australasian Institute of Mining Engineers in 1901. In 1902 he was the mill manager of a Boulder mine (ECGF) and in 1906 was metallurgist at Kalgurli Gold Mines Ltd (ECMF Kalgoorlie). In the same year he was also a member of the Board which enquired for the Mines Department into the organisation of the State Batteries. He subsequently designed an improved battery for Lennonville (MGF Mt Magnet). With W. Middleton, the engineer at Kalgurli GMs, he patented, through the Kalgoorlie patent attorney, W.A. Manners (q.v.), 'improvements in grinding pans' (Australian patent no. 5096). During the 1900s in Kalgoorlie, the Wheeler pan, originally used for amalgamation, was adapted to become a specialist fine grinding machine. Grinding took place between the die in the bottom of the circular pan and a shoe rotating on a central spindle. The shoe wore rapidly worn down, losing 2 inches in three or four months, resulting in an uneven standard of ore reduction. In the Cobbe-Middleton pan its base and the die were moved upwards using a series of weighted levers, so as to maintain a constant relationship between die and shoe, giving the pan a greater grinding capacity. The improved pan was adopted by Kalgurli GMs and Hainault GM Ltd and possibly other Australian mines using grinding pans. The patent was also registered in the Transvaal in 1907 but most of the mines on the Rand developed tube mills for fine grinding. Over the next 30 years the Cobbe-Middleton pan appeared in a number of metallurgical textbooks. In the last third of the 1910s Cobbe established a private practice as a consulting metallurgist, during the course of which he designed a retreatment plant for the Cam and Motor Mine in Rhodesia in 1910, and visited New Guinea in 1912 and British Guiana in 1913. After being head of the section of the Australian Department of Munitions which controlled the supply of scarce minerals during World War I, he resumed his metallurgical practice.

*WAMBEJ* 21 Oct 1905, 5 Jan 1913; *JCMWA* 1905; *MER* Dec 1912; *TIMM* 63, 1953, p.43

**COMPTON**, G. Spencer see **SPENCER COMPTON**, George

**COPLAND**, Maurice Osric BME, MAusIME

After graduating from the University of Melbourne with a degree in mining engineering, Copland worked in the Wallaroo Mines in South Australia in 1902, and was appointed assistant manager of the Long Tunnel Mine at Walhalla in 1903. He prepared a report on monazite deposits in north-east Gippsland for the Victorian Mines Department and was elected a member of the Australasian Institute of Mining Engineers in 1904. After working on the Rand in South Africa, he moved to Kalgoorlie in 1906 to become a lecturer at the Western Australian School of Mines. He resigned from the School in 1914 and joined the staff of the Ballarat School of Mines in 1917. *RDM* 1907, 1914; *ArcAusMM*

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**CORBOULD**, William (Thomas) Henry

(1866-1949)

Born in Ballarat, Victoria, on 5 November 1866 William Corbould was educated at Ballarat College and at the Ballarat School of Mines under the renowned Professor Mica Smith. He started his mining career working as an assayer for several months in 1886 at the silver lead smelter of the Pinnacle Group Silver Mg Co. at Pinnacles near Silverton, NSW. He moved to Broken Hill only eighteen months after the Broken Hill Pty company had been floated. He worked as an independent assayer for several of the Broken Hill mines until he joined Broken Hill South later in 1886 and then moved to Central BHP when it struck the main BHP lode. He left Broken Hill in 1888 to work as metallurgist at the Flora Bell Silver Mg Co near Pine Creek in what was then northern South Australia. In 1889-90 he travelled through South-east Asia and Japan to the USA, where he visited a number of the leading mining centres and worked as a metallurgist in Denver. He visited the UK where he worked for the Elmore brothers on experiments for the flotation process, returning to Australia via Germany and Italy. In Adelaide, in 1891, Corbould was appointed manager and metallurgist for Ediacara Consols Silver Mg Co, a new silver-lead mine 480 km north of Adelaide. Extensive exploration failed to find a payable lode. Corbould travelled to London to seek further finance but when unsuccessful he resigned. On the return voyage to Australia in 1893 he learnt of Hannan's find in Western Australia and joined the 'rush' to Hannan's.

After working several small shows en route to Kalgoorlie, Corbould was appointed manager of Hannan's Hill G Mg Co NL (ECGF, Kalgoorlie) by a South Australian syndicate. He became ill in 1894 and recuperated in Albany and Adelaide. In October 1894 a London group amalgamated Hannan's Hill and Hannan's Reward to form Hannan's Reward GMg Co. On his return to Kalgoorlie Corbould became manager of this new company which employed over 200 people and after a year was producing 170 fine oz per month. In May 1896 he left for London leaving his deputy Steve Harris in charge. Corbould was married in the UK in August 1896 and left for Rossland Goldfield in British Columbia, Canada, where he was consultant, and later general manager, of Canadian Pacific Exploration Ltd on a twelve months contract from February 1897, but he was back in London before the end of the year. He returned to Kalgoorlie at the end of 1899 and again took up the management of Hannan's Reward Ltd (reconstructed July 1898). In Jan 1902 the company amalgamated with Mount Charlotte G Mg Co to form Hannan's Reward and Mount Charlotte Ltd. Corbould disagreed with the new board over development priorities and resigned in December 1902.

He returned to London where he was made manager of Lloyd's Copper Co. Ltd. which had purchased a smelting and refining works at Lithgow and a mine at Burruga, south of Bathurst, NSW. He arrived at the mine in mid 1903 to find that a new water jacket blast furnace recommended by a consultant was unusable and that the existing plant was extremely wasteful in power, labour and time. Nevertheless, by 1905 the overdraft had been paid off and the plant rebuilt including the largest wood-fired reverberatory furnace in the world. However, timber fuel, brought in by bullock team, was getting increasingly expensive. Corbould proposed a narrow gauge railway to bring timber in and to refine the blister copper at the mine but the directors preferred to pay a dividend and Corbould resigned in 1909.

The directors of a new company floated in 1907, Mount Elliott Ltd, offered Corbould the position of general manager and metallurgist of the company's copper mine at Selwyn, south of Cloncurry, in the far north-west of Queensland where the company was building a copper blast-furnace and converter plant. The second-hand plant, which was in poor condition and poorly laid out, was commissioned, with great difficulty, in May 1909 and Corbould threatened to resign unless a new plant was built. The new plant to Corbould's design was commissioned in August 1910 and 204 tons of blister copper were produced by the end of the year. For the next four years the company paid dividends but the high grade ore at Mount Elliott was being depleted. In 1912 the company bought Hampden Consols Mine and several smaller properties the purchase of

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which was in line with Corbould's aim of coordinating the copper industry in the Cloncurry region. When war began Prime Minister Hughes called for Australia's metal industries to cooperate to assist the allies and Mount Elliott was prevailed upon to send its blister copper to the Port Kembla refinery of the Collins House group. The blister copper going to Port Kembla had to contain at least one percent gold. At Selwyn the heavier blister copper containing the gold was run off separately and sent to Port Kembla while the remaining Mount Elliott blister was sent to the company's refinery at Bowen where it was treated at half the cost, an arrangement which intensified the rivalry between Collins House and Corbould. Labour problems increased at Selwyn during the war particularly over the manning of an enlarged smelter which Corbould eventually had to decrease in size. He was in England from 1919 to 1922 attempting to raise money for a centralised processing plant at Cloncurry. When this failed he resigned as Mount Elliott's general manager.

In November 1923 Corbould inspected the newly discovered Mt Isa silver-lead prospect, 110km west of Cloncurry, and obtained options on many of the leases. Mt Isa Mines Ltd was formed in January 1924, with Corbould one of the directors. By 1925 the company had acquired the remainder of the leases. During the next four years Corbould was largely engaged in seeking capital to develop Mt Isa. The Collins House group did not wish to participate with the exception of the London-based W.S. Robinson but his involvement ceased in 1926. Negotiations with a syndicate lead by Anglo American Corporation and Selection Trust also broke down at the end of 1926. In 1927 Leslie Urquhart, of the Russo-Asiatic Consolidated Ltd, agreed to acquire a controlling interest in Mt Isa and Corbould became a non-voting advisory director. Urquhart pressed on with the development of the mine and in the mid-1930s brought in the American Smelting and Refining Company (ASARCO) as partners and Kruttschnitt, from ASARCO, became Mt Isa's general manager.

On behalf of one of Urquhart's companies Corbould visited the Edie Creek Goldfield in New Guinea in 1928. The goldfield had been found in 1926 and a very strenuous climb was required to reach it. Corbould took options of many of the leases and reported to Urquhart on the field's possible development. Whilst in New Guinea he contracted a very painful condition which was probably dengue fever. He recuperated in the south of France and lived there until his death in 1949, aged 83.

Hore-Lacy; *JCMWA* 1902

### **CORDNER-JAMES**, John Henry MIMM, AMICE

Son of a Cornish mining engineer, James, his original surname, was trained as a mining and civil engineer. In 1885, he formed in London, with his younger brother, William Henry Trewartha James (q.v.), James Brothers, mining engineering consultants. For professional reasons both brothers adopted hyphenated surnames: Cordner-James and Trewartha-James. Cordner-James visited Western Australia in 1895 and acquired a number of mines on behalf of the British Coolgardie Prospecting Syndicate, the agency company of James Bros. One of these, at the south-eastern end of the Golden Mile, was launched in London, in May 1895, as Hannan's Star GMs Ltd (ECGF Boulder). Cordner-James was appointed one of its directors and James Bros its manager. This was one of the first instances in which the London promoter of a Western Australian company elected to manage the company's operations rather than only advising it as a consulting engineer. Hannan's Star was the first Kalgoorlie-Boulder mine to adopt the Diehl process for the treatment of its sulpho-telluride ore. Its plant using bromocyanide processing of the slimes commenced operation in June 1900 and achieved a gold extraction of over 92 per cent. In 1908 Hannan's Star amalgamated with its neighbour Boulder Deep Levels to form Hannan's Star Consolidated Ltd. In 1910 a more significant amalgamation occurred when Hannan's Star Consolidated combined with Lake View Consols to form Lake View and Star Ltd which became one of the key mines in the future development of the Kalgoorlie Boulder mines. James Bros became the new company's consulting engineer.

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Cordner-James served on the boards of a number of London-based mining companies some of which were promoted by James Bros and some by other consultants such as Bewick Moreing & Co. The Western Australian mining companies of which he was a director included: in 1897, British Coolgardie Ltd., Hannan's Star GMs Ltd., Murchison United GMs Ltd.; in 1905, Lancefield GMG Co. Ltd., Oroya Brownhill Co. Ltd.; in 1920, Central & West Boulder GMs Ltd., Hampton Plains Estate Ltd., Lake View and Oroya Exploration Ltd., Lake View and Star Ltd, Oroya Links Ltd., Yuanmi GMs Ltd.; in 1940 Lake View & Star Ltd and Lake View & Star Investment Trust.

Skinner 1897, 1900, 1905, 1915, 1920; MYBA 1940; Reid p.298

**CRUTCHETT**, Edgar Alphonso MAusIMM, MCMSSA. (b.c.1866)

Crutchett joined the Moonta Mines in South Australia as an assistant mining surveyor and draughtsman in 1881. He moved to Perth in 1886 where he became a surveyor and draughtsman with Wright and Paterson. He went on to New South Wales where he worked for a number of companies, including the Umberumberka Silver Lead Company, and the Block 10, Junction North and Block 14 mines in Broken Hill. He returned to Western Australia in 1894, working initially as a computer and draughtsman for the Government Land and Surveys Dept at Coolgardie, and subsequently as a partner in Litchfield and Crutchett which carried out surveys for a number of the large gold mines. Elected a member of the Australasian Institute of Mining Engineers in 1909, he was a founding member of the Institute of Mine Surveyors (Western Australia) in 1914. He was at the Great Boulder Pty mine between 1909 and 1936.

WAGFC 27 Oct1894; ArcAusMM

**CULLINGWORTH**, Sydney (b.1865)

Born in England and educated at the Ballarat School of Mines, Cullingworth worked as an assayer and sampler in NSW, spent three years in Tasmania and then became metallurgist at the English and Australian Copper Company in Adelaide. Having moved to Western Australia, he erected a battery at Cue (MGF) and joined Bewick Moreing and Company as their representative on the Murchison Goldfield, inspecting and reporting on potential company mines. After a period in the eastern states, he returned to Western Australia in 1904 and joined the Mines Department as battery manager at Duketon (MMGF Mount Margaret). He was appointed Inspector of Mines in 1905 and moved to Mount Margaret in 1908. Cullingworth gave evidence to the Royal Commissions on 'pulmonary diseases amongst miners' in 1910 and on 'miners' lung diseases' in 1911. He returned to Perth in 1913. In 1918 he worked for Fremantle Trading Company which was engaged in lead mining in the Northampton district and in operating a lead smelter in South Fremantle.

Battye 2, p.361; PSL 1906, 1915

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**DAVIES**, Daniel Kenneth MAusIMM. (1907-1964)

Born in Wales, Davies came to Western Australia with his parents in 1911. He joined J. Mcvee (q.v.) as a pupil in 1926, working on the opening up of the Griffin coal mine at Collie. He obtained his 2nd class certificate of competency (coal mining) in 1931 and became under-manager of the Griffin Colliery in 1932. He obtained his first class certificate of competency in 1934 and became manager of Griffin Colliery in 1940 and chief mine manager for Griffin Coal Mining Company in 1946. Under the managing director, N. Fernie, Davies participated in the development of the Muja Open Cut,

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and in diversifying Griffin's business interests. He investigated ilmenite mining at Bunker Bay and Cape Riche and iron ore mining at Scott River. He was elected a member of the Australasian Institute of Mining and Metallurgy in 1948.

MYBA 1965; ArcAusMM; Bird, J., *Hebe-The Black Jewel*, 1993, pp.107-08.

**DAVIES**, Ellis Harvey MIEAust, MAusIMM. (c.1882-1942)

Davies was educated at Brighton Grammar School in Victoria and served an apprenticeship with Austral Otis, working on the design, manufacture and erection of mining machinery. He studied at Melbourne University and at the Working Men's College until 1905 and worked underground in Victoria for eighteen months before joining Bewick Moreing and Company as assistant mechanical engineer in Western Australia in 1907. He worked on the design and erection of ore treatment plants, and as engineer at Great Fingall Consolidated Ltd (MGF Day Dawn) and at Mountain Queen Ltd. (YIGF Marvel Loch). He was elected a member of the Australasian Institute of Mining Engineers in 1912 and joined Charles Ruwolt Pty Ltd as technical advisor and chief engineer for mining machinery in 1914. He designed and supervised the erection of ore treatment plant at Youanmi in 1936. He was a member of the Institution of Engineers, Australia, and of the WA Chamber of Mines in 1914.

JCMWA 1914; MCER 1936; Hooper p.11; ArcAusMM.

**DAVIES**, Thomas Owen (1860-1908)

Davies was born in Wales and emigrated to Australia where he worked as a mine manager in Queensland and New South Wales. In 1897 he moved to Western Australia where he managed the Mildura GM (DGF) on the Norseman Reef, one kilometre east of Norseman town. Subsequently he worked at Kalgurli GMs Ltd (ECGF Kalgoorlie) and at Oroya Brownhill Co. Ltd (ECGF Boulder-Kalgoorlie) which was formed in 1902 by an amalgamation of Hannan's Oroya GMg Co. WA Ltd and Hannan's Brownhill GMg Co Ltd and which operated until 1910 when it joined two other companies to form Oroya Links Ltd. Oroya Brownhill's peak production was in 1905 when it produced 155 thousand fine oz of gold which was the third highest in the state that year.

DWAE 5, p.218; Ralph p.ii.

**DEAKIN**, Henry Malcolm (d.1899)

Henry Deakin, mining engineer and entrepreneur, was the managing director of the first commercially successful colliery on the Collie coalfield, the Westralian Wallsend Colliery, which he founded in 1898. In 1897 Deakin was the managing director of the Railway Venture GMg Co (BAGF) mine at Broad Arrow which in 1897-99 mined gold ore on part of the same ground as Northam Milling & Mg Co Ltd, the Bewick Moreing-managed company which mined and railed ore to the Seabrook Battery at Northam (see Vanzetti). From the name of Deakin's company it is probable that it also railed ore to Seabrook. In 1897-99 the mine produced 695 fine oz of gold. Deakin was also managing director in 1897 of La Normandie GMg Co (NECGF) at Broad Arrow which appears not to have produced any significant quantities of gold under that name. In 1898 and 1899 he was selling the head frames, winders and other surface equipment from both mines.

In 1898 Deakin became interested in the potential of the Collie coalfield at a time when the Government Mine and the four private companies with leases on the coalfield had all either stopped production or had failed to commence. In November 1898 he tendered successfully for the lease of the Government Mine and reopened it as The Westralian Wallsend Colliery in the following year, having first pumped it dry, retimbered the workings and installed winding machinery. John Evans (q.v.), former manager at Kembula Bulli Colliery, NSW, was his partner in the company and manager of the colliery. Deakin and Evans were also equal partners in the Wallsend general store and in a new hotel in Collie. A contract was signed with



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the Government to supply in two years 20,000 tons of coal. Deakin died prematurely in July 1899. The Wallsend Colliery produced a total of over 1 million tons of coal and operated until 1910 when it was closed by a disastrous fire. Deakin also held Forest Dept. leases and operated timber mills near Bunbury which were used mainly for the cutting of jarrah mine timbering. He was an active promoter to British and American interests of other Australian mining ventures, including copper mines in South Australia, Western Australia and New South Wales. Battye Private Archives MN1088, ACC 3340A.

### **DE BERNALES, Claude Albo**

(1876-1963)

De Bernales was born in London and was educated at Uppingham School and for two years from 1894 at an English-run boarding school in Germany. He was 21 when he arrived in Western Australia in 1897 and began work as a bank clerk in Coolgardie. He tried prospecting but realised that providing mining supplies had a greater business potential. He gained enough mechanical expertise to start a second-hand mining machinery business, Davis Machinery Exchange. Through his company he sold machinery to prospectors who wished to develop their mines. Payment was in terms of gold to be won and if the mine was unsuccessful de Bernales repossessed the machinery and in some cases acquired leases of liquidated companies. Properties he acquired were difficult to develop due to lack of capital so he decided to float his own bank, the 'Mining & Mercantile Bank'. His first visits to London, in 1905 and 1907, to seek finance for the bank were unsuccessful although in 1907 he managed to float several of his mines including Bayley's Mine (CGF) at Coolgardie. In 1909 he planned to float his 'Wiluna Syndicate Ltd' which held a lease of a liquidated company consolidated with other neighbouring abandoned leases which had produced gold. He arranged for one of his partners in the venture, A.E. Morgans (q.v.), the entrepreneur and former WA Premier, to launch the Syndicate in London, which he did successfully. Companies previously mining the Wiluna leases had found that arsenopyrite in the ore presented major recovery problems. The Syndicate was also unable to overcome them and was forced to go into liquidation in 1913. With new flotation processing technologies being developed in Broken Hill, de Bernales felt that a technological solution was not too distant for the processing of Wiluna ore and he retained the liquidated leases. By 1911 he had gained control of the second-hand market in the WA goldfields and had eliminated competition to his Kalgoorlie foundry business. He also had a half-interest in the main construction and machinery erection company on the goldfields and had effective control of the major Perth engineering company, Hoskins & Co. Ltd. After the war de Bernales retained his interest in the flotation process and its possible use at Wiluna. In 1922 he formed a company to promote experimentation into the process and the development of the Wiluna leases. Shortly after, in 1924, the Metallurgical Laboratory of the Western Australian School of Mines carried out the first of its investigations into the use of the flotation process on Kalgoorlie ores. In the following year, 1925, de Bernales had probably the most important success in his career when he floated on the London Stock Exchange, Wiluna Gold Corporation Ltd, with a capital of £0.8 million, which was the parent of Wiluna GMs Ltd., the operating company. An important addition to the Wiluna Board was J.A. Agnew (q.v.), chairman of New Consolidated Goldfields of South Africa, who provided the company with improved access to London financiers. A comprehensive drilling programme of the Wiluna leases located very extensive deposits of low grade ore which greatly improved the company's prospects and made de Bernales realise that for the mine to be profitable more advanced mechanisation would be required. In 1925 at the request of Wiluna GMs' consulting engineer, H.E. Vail (q.v.), the WASM's Metallurgical Laboratory investigated the oil flotation segment of the mine's proposed ore treatment process which consisted of wet crushing, flotation, roasting and cyanidation. The best flotation results were obtained by using a saline pulp with eucalyptus oil for flotation and potassium xanthate as a reducing agent and by washing the flotation concentrate before roasting to remove the salt. The Metallurgical Laboratory carried out three further sets of tests in 1927 and 1929 to determine flotation procedures for three particularly refractory

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Wiluna ores. In one of these sets the auriferous arsenopyrite contained varying quantities of antimony in the form of stibnite. For the first time in gold processing a two stage flotation process was devised in which an antimonial concentrate was removed in the first stage and a gold concentrate in the second. The main stages of the construction and development of the mine began in 1928 and in 1931 mining operations began on what was the most modern large scale mining of low grade ore in the state. De Bernales' long term faith in the project was more than justified by the mine producing gold worth £3.5 million in its first 4½ years, although he sold his interest in the company in 1929. After lobbying by him and the Chamber of Mines the State government contributed to the Wiluna project in a number of ways. Between 1929 and 1932 it extended the government railway 175 km from Meekatharra to Wiluna; it developed water supplies in the region and relaxed the manning requirements on leases. In 1930, aiming at the Federal government, de Bernales embarked upon his 'Gold Bounty' campaign which was intended to encourage gold production in the Depression era despite the static gold price and cost inflation. The government decided to pay a bounty of £1 per fine ounce on production in excess of the previous three years' average. Although it eventually proved redundant because between 1930 and 1939, due to changes in international finance, the price of gold increased from £4.2 per fine ounce to £9.7, the Bounty, nevertheless, gave a much needed psychological boost to the industry and its financiers. De Bernales moved to London in 1932 and between 1932 and 1935 he took advantage of the confidence which the London and Australian markets now had in him to launch eight major investment corporations, known as the Commonwealth Group, with a total nominal capital of over £6 million. These companies and others he controlled were all closely interlocked and had services provided to them by his own companies. Two such corporations were the Anglo Australian Gold Development Ltd and Great Boulder Mining and Finance Co. To each of the corporations his holding company, Australian Machinery & Investment, sold a number of mining leases, most of which had previously produced gold and were further explored by the corporation. Any of the leases which were found to contain payable ore were floated as independent companies. Two such mines were Mt Palmer at Yellowdine (YIGF) and the Comet Mine at Marble Bar (PGF). In 1936 he gained control of Great Boulder Proprietary, one of the oldest and most important mines on the Kalgoorlie Golden Mile, a move which added significantly to his prestige. In 1939 because of opposition to him from powerful financial institutions and parts of the British press the London Stock Exchange suspended trading in seven of his companies without giving any reasons. Consequently a number of his companies were forced into liquidation and a group of shareholders in Great Boulder Mining and Finance Ltd instituted long drawn out proceedings to regain their investments. After the war the British attorney-general came to a decision that there was a prima facie case that an offence had been committed but action against de Bernales was deferred because of his ill health. He died on 9 December 1963.

Snooks pp.64-68; ADB 1891-1939, pp.264-65; Davies pp.4-19; A.S. Winter, 'Report on investigation work carried out in the Metallurgical Laboratory on ore from Wiluna sent in by H.E. Vail Esq' (dated 2 October 1925), *Reports on Investigations conducted in the Metallurgical Laboratory: Bulletin 1*, SMWA 1927, p.34; B.H. Moore, 'Preliminary report on the flotation of sulphide ore from the West Lode, Wiluna Gold Mines, Limited' (23 June 1927) also 'Report on the flotation of sulphide ore from the East Lode, Wiluna Gold Mines, Limited' (2 September 1927), *Bulletin 3*, SMWA 1928, pp.18-21, 23-25; W.G. Clarke and B.H. Moore, 'Progress report (and supplementary progress report) on the flotation of Wiluna antimonial ore' (November 1929), *Bulletin 5*, SMWA 1930, pp.5-18.

**DEEBLE**, William Malachi

(1864-1941)

Deeble was appointed assistant Inspector of Mines in 1900 and was assigned to Coolgardie in 1901, Mt Malcolm in 1903 and Kalgoorli in 1907. While stationed at Mt Malcolm he was responsible for inspecting the Sons of Gwalia Ltd mine (MMGF Leonora) which was managed by Bewick Moreing & Co. He repeatedly warned the mine manager of the dangers of falls of unsupported hanging walls during shrinkage stoping. In March he was forced to take action after his notices that sections of hanging wall required supporting had been ignored. He issued 'stop work' orders wherever lodes were being worked

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within six metres of unsupported hanging walls. In August 1906 he issued another set of seven 'stop work' orders. Deeble blamed the backlog in safety measures on the company's policy of frequently moving managers between mines and on the managers' reputations depending on their ability to reduce costs. He gave evidence to the Royal Commissions on 'Immigration of non-British labour' in 1904, on 'Ventilation and sanitation of mines' in 1905 and on 'Miners' lung disease' in 1911. He moved to Cue as Inspector of Mines in 1913 and retired in 1930.

BB 1900; V&P 1904 -A7, 1905 -6, 1911-12 A6; PSL 1930; SROWA, Mines Dept AN17, Inspector's letterbook.

### **DEGENHARDT, William Russel Luke ASASM, MIMM (1878-1961)**

Born in South Australia where his father was a solicitor in Orroroo, Degenhardt was educated at St Peter's College Adelaide, and joined the SA Railways as an apprentice at their Islington workshops. He studied at the SA School of Mines from which he graduated in 1901 and became a draughtsman in the SAR Chief Mechanical Engineer's office. Moving to Western Australia he worked on the design of a sulphide ore treatment plant for the Associated Northern Blocks in Kalgoorlie (ECGF) before joining Bewick Moreing and Company in 1904 and becoming the company's chief mechanical engineer in Western Australia in 1906. He worked on the power generation and ore processing plants at the Lancefield Mg Co. at Laverton (MMGF Mt Margaret) in 1907, at South Kalgurli GMs Ltd (ECGF Kalgoorlie) in 1907 and at the Sons of Gwalia Ltd mine (MMGF) near Leonora in 1908. At the Sons of Gwalia mine in 1911 he introduced a large up-draught suction gas producer, fuelled by mulga charcoal, to power electricity generation. This installation was the beginning of the change from steam power to producer gas powered electricity generation at the mine. At the Yuanmi GM (EMGF Black Range) at Youanmi in 1912 he designed and commissioned innovative gas producers which were operated on the down draft principal. The producers were fuelled by mulga wood in two metre long billets as they were cut in the bush. He resigned from Bewick Moreing in July 1914 and travelled to London where, in October, he joined the Technical Committee of Lake View and Oroya Exploration Ltd under Herbert Hoover. Lake View and Oroya Exploration had been set up by Hoover to provide the same type of mine management services as Bewick Moreing provided. In December 1915 Degenhardt visited Australia to inspect the mines managed by LV&O Technical Committee. In 1919 Degenhardt became the chief mechanical engineer of the English Selection Trust, and in 1928 he was at the London head office of the South African miner New Consolidated Gold Fields. He was the mechanical engineer for the Lake View and Star Ltd in London in 1935 and was an independent civil and mining consulting engineer in London in 1936. He retired in 1948. His published papers include:

'Condensation in steam pipes' *JCMWA* 8, 1909, p.166;

'Use of indicator diagrams for regulating mill engines and air compressors' *JCMWA* 7, 1908, p.425;

'Measuring boiler feed water' *JCMWA* 7, 1908, p.512;

'Condensation in Steam Pipes' *JCMWA* 8, 1909, pp.166-67;

'Extension fireboxes on Lancashire and Cornish boilers' [Oroya Links] *JCMWA* 9, 1910, pp.340-43;

'Automatic pulp distributor' [Sons of Gwalia] *JCMWA* 9, 1910, p.427;

'Gas engines at Sons of Gwalia Mine' *JCMWA* 10, 1911, pp.321-26;

'Notes on the suction producer gas engine at the Yuanmi Gold Mine' *JCMWA* 11, 1912, pp.126-29;

'Holman pneumatic stamp' [Mountain Queen Mine, Yilgarn] *JCMWA* 11, 1912, pp.187-90;

'Wood-Gas Plants for Mines' *Mining Magazine*, October 1915, pp.203-06.

He also wrote with T.B. Stevens (q.v.) 'The vacuum filter process method in WA' *JCMWA* 10, 1911, pp.12-23

with W.B. Blyth (q.v.) 'Yuanmi Gold Mine, description and operation of new mill' *JCMWA* 11, 1912, pp.255-63, 290-97

*JCMWA* 1908, 1913; Reid p.280; *TIMM* 71, 1961-2, p.696; S.A. Rogers, pers. comm.1992; Nash v.1.

## WESTRALIAN FOUNDERS OF 20<sup>TH</sup> CENTURY MINING

**De MOLE**, William Frederick

(1852-1939)

De Mole was born in London and emigrated as a child with his parents to South Australia. He was educated at Brighton, SA, and trained as a surveyor on railway works. He worked as a surveyor and engineer in partnership with Tripp (1882) and then with G.E. Farrar (1883-84). In 1886 he moved to Victoria, working in the Warrnambool district and Gippsland and in 1888-9 he was in western Tasmania leading an unsuccessful attempt to locate a suitable railway route from the mines at Zeehan to the west coast harbour at Strahan. In 1895 he sailed for Western Australia and in Coolgardie was employed by Bewick Moreing & Co to assess the potential of prospectors' mines for development by public companies. Most of the mines he inspected were north of Coolgardie in the Bardoc and Carnage districts (both BAGF) and near Kunanalling ('25 Mile') (NCGF). He also worked at the Lily Australia GM at Kanowna (NEGF). In 1897 De Mole was engineer for the Gresham Exploration Syndicate but their mines had been poorly chosen and De Mole was unsuccessful in finding promising alternatives. In 1898 he was back in Tasmania leading one of the seven survey teams pegging the alignment for the Emu Bay Railway from Burnie on the north coast to Zeehan. Later in the year he investigated the Buffalo Hydraulic mine at Buckland, Victoria, and sailed for London hoping to raise finance for the mine. He was unsuccessful but was appointed assistant WA manager for Percy J. Ogle & Co, mining consultant and mine manager with offices in Coolgardie and later Kalgoorlie. In 1901 he inspected for the attorneys of the London-based Venture Syndicate its mine at Fields Find (YaGF), Fields Find GM Ltd. After a week at the mine he reported that he concurred with the plans of the manager, T. Butement (q.v.), for the expansion of the mine. Butement commented that De Mole 'seemed a better type of mining man than the one so often seen about the fields in those days when mining experts were plentiful'.

In 1903 De Mole was manager for Ogle of Hannan's North Mine (ECGF Kalgoorlie) and from 1903 to 1907 of North White Feather Gold Mine (NECGF) at Kanowna. He also inspected mines for possible purchase by Ogle. North White Feather was the most productive mine with which De Mole was associated, its annual production rising from 5.5 to 9.8 thousand ounces from 1903 to 1908. Only one dividend of £1,000 was paid in December 1905. In July 1907 De Mole resigned from Ogle after a disagreement with Ogle's partner, C.A. Whitehead, over the management of North White Feather and another of Ogle's mines, Hannan's Main Reef at Niagara (NCGF). In 1908 he made an unsuccessful investigation of a mine at Cooma, NSW, and then sailed for England. Later in the year he spent two months in Morocco with colleagues unsuccessfully seeking a mining concession from the Sultan. The following year he moved to Gympie, Queensland, where he did survey work for roads and railways. After five years the De Moles returned to Adelaide and then moved, in 1916, to Renmark for land development survey work. In the 1920s he did survey and railway design work for Australian Gypsum Co. at Yatala, SA. De Mole died in Adelaide in 1941 aged 84.

S.G. Hart, B.R. & A.M.S. Fleming (comp.s), 'Letters of W.F. De Mole (1852-1939), Mining Engineer 1896-1903', copy EGHS, Skinner 1897, 1906, 1909; *JCMWA* 1903, 1908; pers. comm. A. Fleming 2002; Rae pp.43, 93; DME Bewick Moreing Collection; Anketell cp. 2; *ADB* 8 pp.278-79; Palmer.Yu p.28.

**De PASSEY**, Roy ASASM, MAusIMM.

(c.1891-1967)

After graduating from the SA School of Mines with an associate diploma in metallurgy, De Passey worked for H.N. Tinley (q.v.) in Kalgoorlie, and became an assayer for the Mararoa GM Company (DGF Norseman) in 1908, and for Norseman GM (DGF) in 1914. He returned to Mararoa GM in 1915 as metallurgist and served in a tunnelling company of the AIF between 1917 and 1919. After the war he became metallurgist at the Light of Asia GM (MGF Cue) shortly before it closed in 1920. He was appointed manager of the Marion Bay Gypsum Company in South Australia in 1922 and returned to metallurgy with the Lancefield Treatment Syndicate (MMGF) at Laverton in 1924. He established a private practice as a

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metallurgist and assayer in Kalgoorlie in 1926 and was a Kalgoorlie municipal councillor in 1929-32. De Passey was elected a member of the Australasian Institute of Mining and Metallurgy in 1932 and was the Institute's branch secretary in Kalgoorlie in 1939.

ArcAusMM

### **DICKSON**, Gordon F.

Dickson was one of the mine superintendents employed by Bewick Moreing & Co, mining consultants and mine managers, to supervise mines which it managed. In the second half of 1907 he was superintendent of Hannan's Pty Ltd (ECGF) which had been formed to acquire mining leases in the East Coolgardie Goldfield and to develop them into independent mines. In 1908 and the first half of 1909, Dickson managed Bellevue Ltd (EMGF Mt Sir Samuel) which was the third reconstruction (1907) of a mining company formed in 1896. The early promise of this isolated mine had been unfulfilled and production was winding down to its eventual closure in 1912. From June 1909 to the end of 1910 Dickson was manager of Northern Mines Ltd (EMGF Lawlers) which had been formed in 1907 and consisted of a central crushing plant (part of an earlier mine, East Murchison United) at Lawlers, connected by a steam tramway to two new mines at Waroonga which were being developed. Dickson was elected a member of the Australasian Institute of Mining Engineers in July 1909.

JCMWA 1907-11

### **DIEHL**, Dr Ludwig

Dr Diehl was the German metallurgist who, in 1895-96, was employed by the Hamburg company, Pape, Henneberg and Co., to carry out tests on oxidised gold ore from Hannan's Brownhill GM Co. (ECGF, Kalgoorlie) to determine potential treatment methods. The tests were under the supervision of the Welsh engineer, A.E. Morgans (q.v.), acting on behalf of the mine's consultants, Bewick Moreing & Co. The Hamburg trials were significant because they were probably the first occasion on which filter presses were used in mineral processing to hold crushed ore while gold was removed from it. During 1896 a treatment plant for oxidised ore, designed by the Scottish company, Cassel Gold Extracting Company (Ltd), was built at Hannan's Brownhill mine. The failure of this plant, in March 1896, left Hannan's Brownhill without further working capital. In December 1896 an Anglo-German group, the Anglo-Continental Gold Syndicate, agreed to erect at the mine a plant to replace the failed one, in exchange for Brownhill shares and subject to the plant's satisfactory operation. The plant, designed by Pape Henneberg, was shipped from Germany in June 1897 and its erection was supervised by Diehl and Edward Gunther, a Krupp engineer.

The Syndicate's work in Australia was carried out by its subsidiary, London and Hamburg Gold Recovery Company, of which Diehl was the chief chemist. The German plant was officially opened in January 1899. Its most significant feature was that it was the only oxidised ore plant in Kalgoorlie which cyanided its fine sands and slimes with both potassium cyanide and bromocyanide. London and Hamburg GR Co built a laboratory and testing building on the Hannan's Brownhill lease to investigate ways of treating the Golden Mile sulpho-telluride ore, in particular by the addition of bromocyanide to the cyanide process. This addition, incorporated in what was termed the Sulman Teed process, makes the cyanide a far more rapid solvent of gold. The process was discovered and patented by the British chemists, H. Livingstone Sulman (q.v.) and Frank L. Teed, in 1894. The patent for use in Western Australia was transferred to The Gold Ore Treatment Company of Western Australia which in turn was acquired by London and Hamburg GR Co. which therefore received a royalty when bromocyanide was used as a supplement in the cyanide process.

While Diehl's laboratory was being built in 1897-98 he did some prospecting, or inspecting prospects, on his own account around Yundamindera, a newly prospected area west of Lake Carey (MMGF Mt Morgans), where he acquired five leases

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in his own name. By 1902 these had been transferred to London and Hamburg GR Co. and exploratory mining was under weigh on the Treasure and Pendinnie leases under the management of John Agnew (q.v.) of Bewick Moreing & Co. In 1903 London and Hamburg GR Co sold Diehl's original leases to Mount Margaret Reward Ltd which worked them in conjunction with other local mines. Diehl's leases produced only small quantities of gold.

A first full scale trial of what became known as the Diehl process, at the end of 1899, was undertaken at Lake View Consols mine on a month's production from a ten stamp mill. The year had been a bad one for Lake View as its very rich ore had rapidly declined and its sulphide roaster had performed poorly. Its manager, Callahan, shortly before leaving for London, accepted Diehl's offer of a trial of the bromocyanide process on the mine's sulphide ore. The trial began in December under the supervision of George Roberts (q.v.), the Lake View metallurgist. In the Diehl process, after stamp-milling, the pulp was amalgamated and separated into concentrates and tailings. The concentrates were treated separately by smelting or by roasting and cyaniding, while the tailings were finely ground, agitated with cyanide and bromocyanide, and filter-pressed to remove the gold. An important innovation made by Diehl in the trial was the use, for the first time, of tube mills for fine grinding the tailings. Diehl's tube mill consisted of a revolving steel cylinder

through which the pulp moved continuously and was crushed by flint balls. On 19 January 1900 the *Kalgoorlie Miner* reported the successful completion of the trial and that a gold extraction of 94% had been achieved over the whole month which was better than most people had expected. Lake View Consols announced that the 50 head battery used for oxidised ore was to be converted to treat sulphide ore by the Diehl process. The rebuilt plant commenced operation in September 1900.

Hannan's Star GMs, a neighbour of Lake View Consols, was the first mine to use the Diehl process commercially. The mine had virtually exhausted its reserves of oxidised ore by the end of 1899 and made an agreement with London and Hamburg Co. for the latter to convert the mine's oxidised ore plant into a sulphide mill based on the Diehl Process. The fully operational plant was handed over to the mine on 24 June 1900. Only a small percentage of concentrates was obtained and it was possible to grind these down to slimes in tube mills so that they could be effectively treated by bromocyanide, thus making smelting unnecessary. The gold extraction rate was over 92 per cent, better than the 85 per cent which had been guaranteed.

The third mine to use the Diehl process on its sulphide ore was Hannan's Brownhill, the mine on which London and Hamburg's laboratory and experimental plant were located. The Brownhill Diehl plant did not commence operations until March 1901 but for six months from July 1900 the mine processed its ore at the Hannan's Star Diehl plant but with the addition of concentration and smelting of the concentrates. The builders of the Brownhill Diehl plant had learnt much from the two other Diehl plants and when it commenced operation in March 1901 it achieved a very high gold extraction rate of 97 per cent and had one of the lowest unit costs on the field.

Although the Diehl process was successful most of the other mines had already opted to treat their sulphide ores by the alternative 'dry crush and roast' process. However, one of the advantages of the Diehl process was that a mine could opt to continue to also treat its sulphides by the standard cyanide process until the value of its residues rose to a point where it became economical to treat its slimes with bromocyanide. Ivanhoe Gold Corporation made the change in 1904 but this strategy gave the treatment staff two years of anxiety as the addition of bromocyanide caused the gold extraction rate to drop even further. The cause was the failure of the mine's concentrators to remove fine pyrites from the pulp which reacted with the bromocyanide, a problem which was only solved by changing the type of concentrator. The other large producer to delay adopting bromocyanide was Golden Horseshoe Estates. The change made in 1910 was not announced but a significant fall in the mine's extraction rate was attributed to a difficulty in removing fine pyrites from the slimes, the same problem as Ivanhoe had encountered. In 1912 the company was involved in litigation in London over the use of

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bromocyanide which suggests that the mine may have been using it without a royalty payment. Diehl's move to London in 1913 may have been associated with the case.

Dr Diehl was a director of Gold Ore Treatment Company of Western Australia Ltd in 1905-09 and of Anglo-Continental Gold Syndicate (1899) Ltd until 1909.

GG 1899; *WArg* 19 Jan 1899, 18 Jan 1900, 25 Jan 1900; *JCMWA* 1902; *RDM* 1902; *TIMM* 12, 1904, pp.2-38; Skinner 1905, 1909; *WAMBEJ* Jul 1905, May 1913; *MER* Aug 1914.

### **DIGGLES**, James Arthur

Diggles attended Stanford University, California, where he was a friend of Theodore Hoover, brother of Herbert Hoover. He studied civil and mining engineering and geology from 1891 to 1896 but left the university without graduating. After Herbert Hoover had been employed by Bewick Moreing & Co. in Western Australia, Diggles also sought employment with the company in Australia but a suitable position was not initially available for him. However, in 1906, Bewick Moreing appointed Diggles superintendent of Vivien GMG Co. Ltd, a mine near Lawlers in the East Murchison Goldfield. The mine was established in 1902 and reached its peak annual production of 13 thousand fine oz of gold in 1908. Diggles was transferred to Broken Hill in April 1907 to manage Broken Hill South Blocks silver-lead mine. In 1905 the Kalgoorlie company Lake View Consols had exercised an option to purchase half the shares in the struggling South Blocks mine and the company was restructured. Using new geological advice Diggles was able to start the mine's revival to a more profitable future. He died prematurely in Broken Hill on 14 May 1910.

Nash 1 pp. 354-59, 375; Pers. comm. Prof Limbaugh, Feb. 1999 with typescript 'Hoover associates 1897-08' (31.1.99); Herbert Hoover Pres. Lib., Pre-Commerce, Photos 41-11, 41-16, 41-44; *JCMWA* 1906, 1907.

### **DODGE**, T.C.

Trained as an accountant and employed by Bewick Moreing & Co, mining consultants and mine managers, Dodge worked at Oroya Brownhill Co. Ltd (ECGF Boulder-Kalgoorlie) during 1909 and represented the mine on the Chamber of Mines. He was at South Kalgurli GMs Ltd (ECGF Boulder) from 1910 to 1913 and when the mine amalgamated with Hainault GMs Ltd to form South Kalgurli Consolidated he transferred to the new company and was its manager from 1915 to 1920. During that time the mine had an average annual production of 30 thousand fine oz of gold which was the eighth highest average of any mine in the state.

*JCMWA* 1909-20; RH.Kalg tab 4

### **DON**, David Hector DipBalSM, AMAusIMM. (c.1885-1939)

Don was born in Ballarat and educated at the Ballarat School of Mines from which he graduated with an assay certificate and where he worked as an instructor. He moved to Kalgoorlie in 1908, where he became the assayer and metallurgist to several mines. In 1911 he formed a partnership with F.W. Allsop (q.v.) as consulting metallurgists and assayers. He operated a branch office in Fremantle between c.1916 and 1927, and was elected an associate member of the Australasian Institute of Mining and Metallurgy in 1933. His son, Mervyn, followed his father into the business.

Battye 2, p.897; Reid p.110; *CMWA* 1932, 1938; *ArcAusMM*

### **DOOLETTE**, Dorham Longford BA, MAusIMM. (1872-1925)

Doolette was born in South Australia, the son of George Doolette, an original member of the Coolgardie Prospecting Syndicate which in 1893-94 financed the pegging of a number of valuable leases on the Kalgoorli-Boulder Golden Mile and who subsequently became a director of mining companies working the leases. Dorham Doolette was educated at

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Whinham College, North Adelaide, and the University of Adelaide. He prospected in the Redhill area (CGF) in 1893 and joined a prospecting party sponsored by the Lefroy Coolgardie Syndicate of which his father was chairman and which in 1894 pegged a number of leases in Kalgoorlie-Boulder including the Golden Horseshoe, Golden Link, Central Boulder and Chaffers. Doolette then went north with Charles Northmore and discovered gold in the Niagara district (NCGF) and established the Challenge and Golden Monarch mines in 1895-96. He sold his interests and visited England to which his father had moved. On Dorham's return to Western Australia he spent two years prospecting the Erlistoun, Laverton and Burtville districts (MMGF) and followed the gold rush to the Arltunga field in the Northern Territory. He also examined coal deposits in the Collie coalfield for potential development. In 1897 he was a director of Lefroy GMs (WA) Ltd (CGF Red Hill) and of Burbanks Gold Mine, Estates and Finance Corporation of Australasia Ltd (CGF Burbanks) but in that year he was declared bankrupt. For a number of years he was an examiner of gold mining prospects for Great Boulder No.1 Ltd and in 1905 he became manager of the Never Never mine (YIGF) near Marvel Loch. In 1908 he moved to Mt Magnet to become superintendent of Great Boulder No. 1 Limited's mine, St George GM (MGF). He was elected a member of the Australasian Institute of Mining Engineers in 1909. With V.F. Shallcross (q.v.) he financed the prospecting of C.E. Jones in the Yilgarn Goldfield which led to the discovery of the Bullfinch Proprietary Mine in 1910 and also to one of the last Western Australian gold rushes prior to the 1914-18 war. He married at Mt Magnet and honeymooned in London. On their return he bought a horse stud property at Broadford, Victoria. Doolette was the managing director of Bullfinch Proprietary until 1920, and was a director and attorney for Kanowna Red Hill GM Co.(NCGF Kanowna) in 1920-24.

Skinner 1897, 1915; *JCMWA* 1909, 1913, 1920; *MER* Feb 1911; *RDM* 1920, p.36; *WArg* 30 Mar 1920; *ArcAusMM*; Ralph pp.2-6,13-14; *ADB* 8 pp.23-24; Battye, 2, pp.352-3; Reid pp.193, 202, 222

### **DRAGE, James**

Drage was chief engineer at Ivanhoe Gold Corporation Ltd (ECGF Boulder) and represented the mine on the Chamber of Mines from 1906 until when the mine closed in 1924, during the managements of R.B. Nicolson (q.v.) (1902-1917) and J. McDermott (q.v.) (from 1918). Ivanhoe's annual gold production peaked in 1903 at 130 thousand fine oz and in every year of the subsequent decade it produced more than 100 thousand fine oz. The company paid more than £2.6 million in dividends by 1910 and over £3.8 million by 1919. Ivanhoe's sulphide ore treatment costs were the lowest of any of the large mines on the Golden Mile. Its sulphide ore processing plant was essentially an extension of standard stamp-milling practice. It was adopted because the mine's refractive sulpho-telluride ore was initially concentrated in one part of the mine and could be mined and treated separately. As the mine deepened the sulpho-telluride ore became more disseminated. By 1904 the amount of gold left in the slime residues became unacceptably large and it became necessary to add bromo-cyanide to the slimes treatment. To the metallurgists' surprise the extraction rate actually decreased instead of improving. The cause was a reaction between the bromo-cyanide and very fine pyrites in the slimes. It took two years of experimentation to develop an effective means of removing the pyrites which entailed Drage making repeated alterations to the engineering systems. In the end the low treatment costs were maintained but the gold extraction rate remained lower than at the mines using the 'dry crush and roast' method of sulphide ore treatment. Drage was elected a Member of the Australasian Institute of Mining Engineers in 1909. He had an interest in improving process machinery. In 1910 he obtained Commonwealth Patent No. 17181 (21 Feb 1910) for 'improvements in filtering machinery'. *JCMWA*

1912-1920; W.G.Manners, Patent Attorney, 'Register of Patents [applied for]'



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**DUDLEY**, Uriah MAusIME, FGS.

(c.1853-1909)

Born in England but educated in Geelong, Dudley served an apprenticeship with J. Walker, a mining engineer in Ballarat, and worked initially in the mines at Broken Hill, becoming manager of the Umberumberka mine at Siverton and of the White Rock mine at Drake. In 1882, during the major industrial dispute at Broken Hill, at a meeting of the Amalgamated Mining Managers' Association of Australasia at Ballarat, Dudley proposed that an Australasian Institute of Mining Engineers be formed. A Provisional Council, of which Dudley was secretary, was formed and the inaugural meeting of the Institution was held in Adelaide in April 1893. Dudley served as its secretary until 1896, the year in which he moved to Western Australia. He was manager of the Emperor Gold Mines at Day Dawn (MGF) in 1902 and subsequently of mines at Cue, Day Dawn and Meekatharra and, later, of ones in the Eastern Goldfields. He was the member of the Board of Conciliation representing the employers in 1902-3 and again in 1905, and gave evidence to the Select Committee on Ventilation and Sanitation of Mines in 1905. His published papers include 'Mine models and mine plans' *TAIME* 1, 1893; 'Ore zones of the Umberumberka Lode' *TAIME* 1, 1893; 'A mining puzzle' *TAIME* 11, 1906.

AMS 17 June 1893; WAGC 29 Aug 1896; WArg 28 Oct 1902; Skinner 1903, 1904; RICA 1901-5 p.209, 1905 p.338; JCMWA 1902, 1905; Gibney/Smith 1, p.194; Dew, pp.11-12, Appendix 1

**DUNSTAN**, John ABalSM, MAusIME.

(b.1858)

Educated at the Ballarat School of Mines where he obtained a certificate in assay and metallurgy, Dunstan became manager of the English and Australian Copper Company in South Australia in 1891, and then spent two years at its Junction smelting works at Port Pirie. He became manager of Champion Reef GM Co. Ltd (MGF Meekatharra) at Nannine in Western Australia in 1896 and, in 1899, was attorney for Caledonian Extended (MGF Meekatharra) and for a mine at Cue (MGF Day Dawn). In 1900 Dunstan was metallurgist under T. Hewitson (q.v.) at the Associated Gold Mines of Western Australia (ECGF) at Kalgoorlie. At the mine he converted the crushing and treatment from a dry process to a wet process. He was elected a member of the Australasian Institute of Mining Engineers in 1901 and in 1905 he was manager of Ravensthorpe smelting works which was built by the Government at Cordingup Gap (PRGF Ravensthorpe). The smelter was not a success as it was too small and badly sited. It closed in 1906. While at Ravensthorpe Dunstan was also Inspector of Mines for the Phillips River Goldfield. In 1907 he was appointed Superintendent of State Batteries under A. Montgomery (q.v.), a post which he held until 1912. He then became manager of Beria Consols Mine (MMGF Mt Morgans) which was 10 km north-west of Laverton. The mine had previously been known as Lancefield GM but when the company went into liquidation, in 1913, it was bought by Kalgoorlie and Boulder Firewood Company, the company which operated the woodline which provided the mine with timber fuel. Dunstan managed the mine until 1915 when it was purchased by Kalgoorlie investors and redeveloped. Dunstan was a consultant in Perth in 1929. His work for the state batteries was described in 'State battery system' *WAMBEJ* 14 Aug 1909.

Skinner 1897; Clark p.76; *WAMBEJ* 23 Sep 1905, 27 Apr 1907, 2 May 1914; RDM 1905, 1912; *MER* Feb 1914; JCMWA 1915; Reid p.257; ArcMM; Gunzbg/Austin p.200; Quartermaine. Ravensthorpe

**DUNSTAN**, Milton Thomas ASTC, MAusIMM.

(c.1885-1953)

Dunstan worked in the laboratories of the Broken Hill Company while studying at Broken Hill Technical College from which he graduated in 1910 when he became an assayer at the British Mine at Cassilis in Victoria. He then joined Bewick Moreing & Co. and was appointed chemist for Burma Mines Ltd, a company which was developing a very rich silver lead deposit at Bawdwin, in north-eastern Burma, which had been a former ancient Chinese mine. The company opened a lead smelter in 1909 in Mandalay where Dunstan was probably employed. He came back to Australia to work at Lake View and Star

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Ltd (ECGF Boulder) under H.E. Vail (q.v.) in 1914-17. He returned to Burma where he worked for Burma Finance and Mining Company, the new managing company of Burma Mines, for approximately 15 years. He was manager and metallurgist at the Marvel Loch Gold Development (YIGF Marvel Loch) in 1934-37. After one year at Mount Ida (NCGF) he was at the Banker Mine at Marvel Loch (YIGF) in 1939, the New Yilgarn GM, also at Marvel Loch, in 1940, and at Eldorado GM in Tennant Creek, Northern Territory, in 1941. He was elected a member of the Australasian Institute of Mining and Metallurgy in 1944.

ArcAusMM; Nash v.1

## E

**EDMANDS**, Herbert Richard MAusIMM

Born in London, Edmands trained as a chemist in South Wales at one of the goldmines opened by promoter Prichard Morgan. Edmands travelled to the USA in 1885 where he worked in the mining industry in California and Arizona and other states. He arrived in Western Australia in 1895 and from 1900 to 1910 was manager of Menzies Mining and Exploration Corporation Ltd (NCGF Menzies) and for several years was also the representative in the Chamber of Mines for Riverina South Leases GM at Mulline (NCGF). He was elected a member of the Australasian Institute of Mining Engineers in 1901. From 1913 he was chemist at Yuanmi GMs (EMGF Black Range, Youanmi) where he with metallurgist K.B. Moore (q.v.) he sought more effective means of precipitating gold in the cyanide process. In 1915 they invented an alternative method in which zinc dust was held by suction on the outside of a modified vacuum filter through which the gold solution was drawn, precipitating the gold. The unit which they called the Moore-Edmands extractor partly anticipated the Merrill-Crowe precipitator which required the de-aeration of the gold solution and which became an industrial standard in the 1920s. Moore and Edmands had not realised the significance of excluding air from the precipitation process but the two processes were otherwise almost identical. Because of the shortages of zinc in wartime Edmands substituted pulverised charcoal for zinc dust in the Moore-Edmands extractor which improved the gold extraction rate from 92.8 to 98.7 per cent. Edmand's paper to the Institution of Mining and Metallurgy in 1918 on carbon precipitation at Youanmi led indirectly to further investigations by the US Bureau of Mines and Precious Metals which suggested the possibility of a carbon-in-pulp gold extraction process which is the basis of a major part of modern extraction practice. Edmands was attorney for the Riverina South Leases between 1921 and 1925.

His published papers include 'Filter press treatment of slimes' [Menzies] *TAusIME* XI, 1906, pp.77-96;

'Wood fuel for assaying' [Yuanmi GMs] *JCMWA* 14, 1915, pp.92-94;

'Some notes on the effect of lead salts and of varying degrees of alkalinity on the solvent power of cyanide solutions for gold' *JCMWA* 15, 1916, pp.63-70, corrections: pp.143-45;

'Charcoal as a precipitant of gold from its cyanide solutions' [Moore-Edmands extractor] *JCMWA* 16, 1917, pp.214-20:

'Application of charcoal to the precipitation of gold from its solution in cyanide' *TIMM* 27, 1917-18, pp.277-325;

and with K. Byron Moore 'Treatment of arsenical-antimonial sulphide ore at Youanmi' *JCMWA* 14, 1915, pp.12-17.

Skinner 1899, 1900, 1903; *JCMWA* 1903, 1904, 1908, 1920; RDM 1910, p.210; Hooper p.86

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### **EDOLS**, John H.

Born in Victoria, Edols worked on the Murchison Goldfield for a short time before joining, in 1895, Hannan's Proprietary Development Co. (ECGF Kalgoorlie). In 1897 he became general manager of the Brown Hill Central Mine (ECGF Kalgoorlie) which produced 2195 ounces of bullion in 1899. Edols joined the executive council of the Coolgardie Chamber of Mines in 1899, and was the temporary manager of Hannans Main Reef GMg Co (ECGF) in 1899-1900 before its second reconstruction in Oct 1900 (managers: Percy Ogle & Co.). He was at an unsuccessful mine at Hogan's Find, near Bulong, in 1903-04, and then at the Britannia GMg Co. (ECGF) and at Kalgurli GMs Ltd (ECGF Boulder) in 1904 when the mine produced 46 thousand ounces of fine gold which was the tenth highest total for a single mine in the state in that year. In 1905 Edols was at the Hainault GMs (ECGF Boulder) when the mine produced 20 thousand fine oz which was near its average annual production between 1905 and 1912. Edols left Western Australia in 1907.

*WArg* 21 Nov 1895; Skinner 1897; 1905; *JCMWA* 1903, 1904; 1905; *GG* 1904 p.151; M.K. Quartermaine, pers. comm. 1990

### **EDQUIST**, Victor Thomas ASASM, MIMM, MAusIMM, MACI. (1879-1944)

Edquist was born at Talbot in Victoria and was educated in Adelaide but had to leave school early for family reasons. He worked in an office but continued to study in evening classes at the SA School of Mines. In 1900 he obtained a job as a store-keeper, later also assayer, at the Prince of Wales mine at Reno, near Gundagai in NSW. When the mine went into liquidation in 1902 he and an associate formed a company to treat the mine's tailings with cyanide. After five years of profitable operations, Edquist moved to Western Australia where, initially, he treated sulphide concentrates from the Redhill Westralia mine (CGF Coolgardie). In 1909 he was elected a member of the Australasian Institute of Mining Engineers and moved to Kalgoorlie where he designed and operated slimes retreatment plants using the new technique of vacuum filtration. In 1912 he joined Bewick, Moreing and Company as a metallurgist, working at the Mountain Queen Mine at Marvel Loch (YIGF) and at Meekatharra (MGF). In 1914 he moved to the Great Fingall Consolidated mine at Day Dawn (MGF). There he successfully replaced the vacuum filtration of slimes with continuous counter-current decantation which was the first time this technique had been used in Australia. In 1916 Edquist was appointed metallurgist at Yuanmi GMs near Sandstone (EMGF Black Range) where a new method of precipitating gold by charcoal instead of zinc was about to be introduced. In August 1916 Edquist, working with the mine's chemist, H.C. Edmands (q.v.), established the new precipitation system and, as at Great Fingall, he replaced vacuum filtration with counter-current decantation.

After five years at Yuanmi Edquist resigned to join a new mine at Big Bell but its finance failed and he rejoined Bewick Moreing & Co as metallurgist at the Sons of Gwalia Ltd mine (MMGF Leonora) in 1922, a year after fire had destroyed much of the mine's surface works. Edquist's top priority was to establish a plant for the reprocessing of the accumulated tailings of sand and slime to provide a cash flow for the mine. While at the Sons of Gwalia he gave evidence to the Royal Commission into Mining in 1925. He was appointed manager of the mine in May 1927 and helped negotiate the loans made by the State Government to the company which were tied to a programme of development work and machinery acquisition.

In the early 1930s Edquist supervised a significant increase in the scale of producer gas utilisation at the mine which became one of the largest industrial operations to substitute producer gas for steam as a power source for all uses except for powering the winder engine. Edquist had a career-long interest in the charcoal precipitation of gold and his 1934 Australian patent for precipitation by charcoal and the recovery of charcoal by flotation was the forerunner of the modern carbon in pulp process. He also held a patent for softening water which he presented to the Australian Government, which utilised it on the Trans-Continental Railway while steam locomotives were in use.

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Edquist was appointed Bewick Moreing's senior representative in Australia in 1935 and moved to Melbourne. He was a member of the executive council and vice-president of the WA Chamber of Mines between 1928 and 1939. He was a member of the council of the Australasian Institute of Mining and Metallurgy in 1937, a vice-president in 1940-41 and its president in 1942. He was a director of the Aberfoyle Tin NL (Tasmania), Morning Star GM NL (CGF Coolgardie), Edna May Amalgamated GM (YIGF Westonia) and Maryborough Gold NL (Victoria). He died in 1944, aged 65.

His published papers include: 'Treatment of concentrates at Red Hill Westralia Mine' *JCMWA* 6, 1907, p.354;  
'Recovery of gold-bearing charcoal on retreating filter-pressed slimes' [G. B. Perseverance] *JCMWA* 10, 1911, p.152;  
'Continuous decantation at Yuanmi Gold Mines Ltd' *JCMWA* 16, 1917, pp.262-67;  
'Converting an agitator into a continuous thickener' *M&SP* 11 May 1918;  
'Boiler water treatment' *ProcAusIMM* 65, 1927, pp.1-10;  
'A review of the gold mining industry of Western Australia' *ProcAusIMM* 128, 1942, p.171-76;  
and with C. Valentine (q.v.) and N. Dunstan, 'Gas power generation at the Sons of Gwalia Mine' *ProcAusIMM* 88, 1932, pp.479-506.

RDM 1910 p.210; *JCMWA* 1920, 1929, 1940; *MCER* Oct 1935, p.473; *MYBA* 1940; *WWA* 1944 p.320; 'Obit' *ProcAusIMM* 134, June 1944, viii; *TIMM* 54, 1944, pp.262-65; Edquist, V. Jnr, 'Innovation in the Western Australian Outback' *Second AusIMM Mineral Heritage Seminar*, Sydney, 1988, pp.53-60

**ELLIS**, George Frederick AIMM (d.1914)

Ellis graduated from Kings College, London, in 1892. From 1896 he spent five years working at Western Australian gold mines. In 1896-97 he was manager of Lady Forrest GM (MGF Cue) at its start-up and, in 1897-99 he was mill manager at Peak Hill Goldfields Ltd (PHGF Peak Hill). In 1897 the company had bought up almost all of the 27 small neighbouring leases and had installed a steam tramway to bring ore to its crushing plant. In 1899 Peak Hill produced 31 thousand oz of bullion which was the eighth highest quantity produced by any mine in the state that year and the highest by any mine outside Kalgoorlie. Peak Hill ore was rich with a yield of 67 dwt per ton but the goldfield was very isolated. The distance to the railhead at Cue via Nannine was 280km and the fastest traffic along the winding track to Nannine, the postal service and gold escort, took six days. The transport to the mine of the headframe, mine timber and surface plant was a major undertaking. In 1900 and 1901 Ellis was manager of Hannan's Treasure Trove Co. Ltd (ECGF Boulder). The mine's leases, in the south-eastern corner of the Golden Mile, encroached on the Trafalgar townsite and produced no significant quantities of gold. Ellis was an associate of the Institution of Mining and Metallurgy and died in 1914.

*TIMM* 1914-15; Heydon pp.67-68, 78-79

**EMBLETON**, Joseph M. (d.1925)

Embleton was at South Kalgurli GM Ltd (ECGF Boulder) in 1907 when it raised 95,000 tons of ore to yield over 32,000 oz of gold. In 1914 the mine combined with Hainault GMs to form South Kalgurli Consolidated. Embleton was manager of the amalgamated company from 1915 to 1920 during which it produced an average of 29,000 ounces a year. Embleton gave evidence to the Royal Commission on Miner's Lung Diseases in 1911, and was a member of the executive council of the WA Chamber of Mines 1916-20.

*MER* Apr 1914, p.197; *JCMWA* 1910, 1920, 1925; Skinner 1920

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**ESPIE**, Frank Fancett BE, FSASM, MAusIMM, MIMMAmer (1891-1962)

Born in Adelaide, Espie was educated at St Peters College and at the University of Adelaide and the SA School of Mines where he studied mining and metallurgy. After graduating in 1913, he worked for short periods in Kalgoorlie and in Broken Hill, and then joined, in 1914, the Burma Corporation, the company formed in 1913 by Herbert H to become general manager of the operations of Burma Mines Ltd which was mining a large silver-lead deposit at Bawdin in north-eastern Burma. At the mine Espie supervised the driving of the Tiger Tunnel which was an adit, 2250 m long, driven into the side of a mountain to open up a newly discovered ore body. He also worked on the construction of the hydro-electric plant at Mansam Falls. He became assistant superintendent of the mine in 1932, its superintendent in 1940, and general manager in 1941. After the invasion of Burma by the Japanese he supervised the demolition of the mechanical plant at the mine and successfully led his staff on a hazardous evacuation over-land to India through Upper Burma and Assam. He returned to Australia in 1942, and became general superintendent in Western Australia for Western Mining Corporation in 1943, a post which he held for fifteen years. In 1947 Espie was appointed a director of Gold Mines of Australia, of Western Mining Corporation, of Gold Mines of Kalgoorlie and of Central Norseman Gold Corporation. He joined the board of Gold Mines of Australia in 1948. He was appointed the deputy managing director of Western Mining Corporation in 1952 and a director of Broken Hill South in 1956. He was transferred to Melbourne in 1958. He was elected a member of the Australasian Institute of Mining and Metallurgy in 1918 and its president in 1948. He was awarded the Gold Medal of the Institute in 1953. He was a vice-president of the Western Australian Chamber of Mines in 1950 and in 1957. He was a director of Gold Exploration and Finance Company Ltd from 1947 and of several associated companies including Kalgoorlie Southern in 1951-1960, and of Great Western Consolidated. He was elected a member of the Institute of Mining and Metallurgy of America in 1919.

*MCER* Aug 1954, pp.437-39; Lloyd p.108; *MYBA* 1941; *CMWA* 1946, 1957, 1963; L.Clark pp.96-109; *ArcAusMM*

**EVANS**, John (1860-1950)

Evans started his career in coalmining in Wales in 1881. He emigrated to New South Wales in ca.1885, and spent some time working at Bulli colliery. He moved to Western Australia where he worked with H. Deacon to establish the first commercial colliery at Collie which opened in 1897 as the Wallsend Colliery. After Deacon's sudden death Evans became engineer and manager of the colliery and later also of the collieries of two other companies, Collie Proprietary Coalfield of Western Australia Ltd in 1899, and of Coalfields of Western Australia Ltd. in 1905. He gave evidence on the coal industry at Collie to two Select Committees in 1901, and to two Royal Commissions in 1898 and in 1905. He installed an electric power plant for the coalfield and introduced electric ventilation in 1903. His career after 1905 continued in Victoria.

*WAMBEJ* 2 May 1903 p.16, 20 June 1903 p.8; Clark p.129; Skinner 1903, 1904, 1905; *MCER* Nov 1950, p.8; H. Deacon Batty Lib. Priv. Arch.

## F

**FELDTMANN**, William Robert. MIMechE, MAmIME, MIMM, MCMSSA. (1865-1938)

Born in Milton, Glasgow, Scotland, on 30 Jan 1865, Feldtmann was the third son of Rudolf Feldtmann who was born in Schleswig-Holstein and owned an ironworks in Glasgow and another in Whitehaven (Cumbria). William Feldtmann was educated at Glasgow Academy and the Freiberg School of Mines, where he studied mining and metallurgy. Returning to

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Glasgow he joined Cassel Gold Extracting Co. Ltd which had been set up in 1884 to develop a gold recovery process based on the use of chlorine and electricity invented by an American H.R. Cassel. Despite Cassel terminating his connection with the company in June 1886 Cassel Co. continued to test the process. In March 1887 the company sent Feldtmann to Brazil to set up a prototype Cassel plant at the St. John del Rey's Company's mine to fulfill an obligation made earlier to the del Rey Co. Meanwhile, the technical manager of the Cassel Co., John S. MacArthur, continued to test the Cassel process intensively. On 20 May 1887 he reported to the Cassel board that the process was unsatisfactory so Feldtmann was recalled from Brazil. He returned after having been in Brazil for more than a year. Since 1885 MacArthur and two medical doctors Robert and William Forrest had been experimenting in their own time into ways of recovering gold from its ores. They had agreed to offer any patents derived from their work to Cassel. In 1887 they made their first discoveries into the use of potassium cyanide for gold recovery and in 1887 and 1888 Cassel took over the patents which covered the full cyanide process. Feldtmann probably was involved in the intensive testing of the process on ores from different goldfields that the company carried out in Glasgow. In 1888, however, he moved to South Africa to work on the Johannesburg goldfield. At the end of the same year Cassels decided to send one of their leading metallurgists, Alfred James (q.v.), to South Africa to investigate the potential use of the cyanide process on the Rand. It is not clear whether Feldtmann assisted James or was involved in the first demonstration of the cyanide process by Cassel at the Salisbury Company's works near Johannesburg in June 1890. However during the ten years that Feldtmann was in the Transvaal he spent two years as superintendent-metallurgist of the African Gold Recovery Company which was set up (in March 1891) by the Cassel Co. to promote the use of the MacArthur-Forrest process. Feldtmann was vice-president of the Chemical and Metallurgical (and Mining) Society of South Africa in 1895 and 1896 and was president of the Society for the subsequent two years. He wrote several papers for the Society. He moved to Western Australia in February 1898 where he was engaged by Bewick Moreing and Co. as a consultant-metallurgist. Later in the year, Bewick Moreing appointed him superintendent of the Hannan's Brownhill mine (ECGF Kalgoorlie). Anglo-Continental Gold Syndicate's subsidiary London and Hamburg Gold Recovery Company had just started testing its oxidised ore treatment plant at the Brownhill mine which Anglo-Continental had designed to replace the original Cassell-designed plant which had been a failure. The mine was then working very rich sulphide ore from the Oroya Shoot (6 oz per ton) which was sent for smelting in South Australia. After Bewick Moreing's resident partner in Western Australia, Edward Hooper (q.v.), returned to London in 1898 and Ernest Williams (q.v.), the next senior Bewick Moreing representative in the colony, resigned in 1899, Feldtmann was made Western Australian manager of the company. He was appointed one of the commissioners to collect mining exhibits for the Glasgow Exhibition of 1901 and was an inaugural vice-president of the Western Australian Chamber of Mines in 1901.

In 1901 Herbert C. Hoover (q.v.) was appointed Bewick Moreing partner responsible for operating the mines managed by the company. When he arrived in the state, in January 1902, Feldtmann worked with him on plans to revive the operations of the Lake View Consols mine (ECGF Boulder). Feldtmann was also involved in the management take over by Bewick Moreing of the Cosmopolitan Pty Ltd mine at Kookynie (NECGF). In November 1902 he resigned from Bewick Moreing and returned to the Transvaal, later moving to London where he worked as a mining consultant, establishing W.R. Feldtmann and Company in 1910. His principal clients were British companies with mines in the Gold Coast and South West Africa. He was managing engineer of Ashanti Goldfields Pty in 1909-20 which entailed annual visits to the Gold Coast. He also managed Bibiana Ltd. and Sansums Mines Ltd. in 1909. He was general manager of the South-West Africa Company from 1926 to his death in 1938. The latter was founded by Edmund Davis who had also formed the Anglo-Continental Gold Syndicate and the London and Hamburg Gold Recovery Company. Feldtmann died on 6 April 1938 at Grootfontein, South West Africa.

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His publications include: *Notes on gold extraction*, Johannesburg, c.1892; President's Address, 18 July 1896 (Improvements to the cyanide process), *Proc CMSSA* 1894-97, pp.234-38; (with W. Bettel) 'Notes on the estimation of sulphides and cyanates in commercial cyanide', *Proc CMSSA* 1894-97, pp.267-71; 'The wholesale idea in gold mining' *TIMM* 18, 1908-09, pp.355-66; 'Precipitating action of carbon in contact with auriferous solutions' *TIMM* 24, 1915-16, pp.329-71.

Lougheed pp.1-17; *WArg* 19 Jan 1899, 8 Jan 1900; Thiel p.200; *MM* Jan 1916 p.340, Oct 1916 p.227, Dec 1916 p.347; *WAMBEJ* 13 Jun 1903; *JCMWA* 1902, 1920; RH.Kalgoorlie ch 1.3; Skinner 1905; 1909; 1915; 1920; *MCER* June 1938; *TIMM* 48, 1938, pp.831-32; pers. comm. A. Fleming 2010

**FELDTMANN**, Francis Rudolph AWASM (b.1881)

Feldtman, the nephew of William Feldtmann (above), was born in Whitehaven, England, and emigrated to Australia in 1900 to join his uncle in Kalgoorlie. He stayed in Kalgoorlie after the departure of his uncle and studied at the Western Australian School of Mines (1904-08) and graduated as an AWASM. In 1908 he moved to Sydney where he worked as a draughtsman. In 1911 he was appointed as field geologist with the Geological Survey of WA and worked for the GSWA for the rest of his working life. He married Florence De Mole, the daughter of William De Mole (q.v.).

Pers. comm. A. Fleming 2010

**FISHER**, William Hamilton AMAusIME. (b.c.1868)

Fisher spent more than two years working as assayer at the Hillbend West GM (BAGF) at Broad Arrow, and as the cyanide manager of the Lady Loch GM Ltd (CGF) near Coolgardie. He spent five years in the sulphide mill of Great Boulder Pty GMs Ltd and after working as mill foreman for Bewick Moreing & Co. at the Vivien GMG Co. Ltd at Lawlers (closed 1912), he became battery manager for two state batteries. He was elected a member of the Australasian Institute of Mining Engineers in 1913 and was in Kalgoorlie in 1917.

ArcAusMM

**FITZGERALD**, Patrick MIMM. b.1870

Born in Otago, New Zealand, and educated in Dunedin, Fitzgerald studied mining engineering at Otago University where he obtained an associateship in mining and metallurgy and certificates in mining surveying and metallurgical chemistry. He worked in the mining industry in New Zealand and Tasmania until appointed lecturer in metallurgy and assaying at Otago University. In 1887 he moved to Western Australia where he had been appointed metallurgist for Hannan's Brownhill GMG Co (ECGF Kalgoorlie) under the general management of Bewick Moreing and Co., mining consultants and mine managers. Fitzgerald was closely involved in the introduction to Kalgoorlie of the Diehl bromo-cyanide process for treating sulpho-telluride ores. The company which developed it, London and Hamburg Gold Recovery Co, had its laboratory and testing area on the Brownhill lease as it had the contract to build an oxidised ore treatment plant for the mine. The inventor of the process, Dr L. Diehl (q.v.), developed variations of the process for three Kalgoorlie mines. The first two Diehl plants, at Hannan's Star GMs and Lake View Consols (both ECGF Boulder) both commenced operation in 1900. The third at Hannan's Brownhill did not start operating until March 1901 but it achieved a very high gold extraction rate of 97 per cent and had one of the lowest unit costs on the field.

When Hannan's Brownhill amalgamated with Hannan's Oroya GMG Co, in 1902, Fitzgerald moved to the Sons of Gwalia Ltd (MMGF), at Leonora, as cyanide manager. In that year the mine produced 64 thousand fine ounces of gold which was the second highest annual total of any mine outside Kalgoorlie-Boulder in that year. In 1905 Fitzgerald was appointed manager of Vivien GMG Co (EMGF Lawlers) which was ten miles north of Lawlers. In 1907 he was manager of Northern

## WESTRALIAN FOUNDERS OF 20<sup>TH</sup> CENTURY MINING

Mines which had been registered that year and consisted of two adjacent mines Waroonga South and Waroonga GMS (both EMGF) 8 km north of Lawlers. He resigned from Bewick Moreing later in the year and proceeded via London to the Gold Coast, West Africa, to manage the Prestea Block A Mine near Tusqua, where he also acted as assistant superintending engineer to some mines controlled by the Consolidated Goldfields of South Africa. After three years in the Gold Coast he returned to London where he was commissioned to make an inspection tour through northern Nigeria which he completed in six months. He returned to Western Australia in 1910 to become engineer and general manager of Oroya Links Ltd (ECGF Kalgoorlie). This company had been formed in 1909 by an amalgamation of Oroya Brownhill, Golden Links and Kalgoorlie Amalgamated (New) and held leases in the north-eastern and south-eastern sides of the Golden Mile. The company's mines produced about ten per cent of the Golden Mile's total production. Fitzgerald remained in charge of Oroya Links for seventeen years, retiring in 1924, four years before the mine closed. He settled in Perth. In 1905 Commonwealth Patent 4313 for 'improvements in the decantation of cyanide and like solutions' was registered and in 1906 was re-assigned to Fitzgerald and in 1912 he renewed it. In 1906 he registered a completed Commonwealth Patent 6883 for 'an improved method of leaching slimes or slimey pulp and extracting precious metals therefrom'.

*WArg* 19 Jan 1899 p.8-9, 11 Nov 1902 p.5; Skinner 1906, 1915, 1920; RH.Kalg ch 5.3; *MER* Nov 1910, p.73; *JCMWA* 1905, 1913, 1920; Battye 2, p.345; Reid pp.67-68; Palmer.Ag, pp.7-15; Patent Register of W.G. Manners

### **FLEMING, S.G.**

In 1902 Fleming worked at West Fingall Ltd (MGF Day Dawn) where he was employed by Bewick Moreing & Co who managed the mine. West Fingall was formed in 1900 from leases which had previously been owned by Great Fingall Consolidated. The mine closed in 1904. Fleming was at another Bewick Moreing-managed mine, Cosmopolitan Pty (NCGF Kookynie) for three years (1909-11) during which he represented the mine on the Chamber of Mines and for the last two he was manager of the mine. The mine had produced more than 50 thousand fine oz in its peak year of 1903 but at the end of the decade it was in its last stages of operation and closed in 1911. *JCMWA* 1904-11

### **FOXALL, John Stuart** BE, MIEAust. (1887-1967)

Foxall was the surveyor at the Sons of Gwalia Ltd (MMGF Mt Malcolm) from 1911 until 1915 when he enlisted in the AIF. He served in the First Australian Tunnelling Company in France and Belgium. He returned to the Sons of Gwalia after the war but moved to Sydney where he studied for a degree in engineering. In 1925 he returned to Western Australia to work in the Goldfields Water Supply section of the Public Works Department and was elected an associate member of the Institution of Engineers, Australia. In 1935 he transferred to the Mines Department to become an Inspector of Mines. He was appointed Assistant State Mining Engineer in 1937 and State Mining Engineer in 1945. He retired in 1952 and was succeeded by E.E. Brisbane (q.v.). During Foxall's period as Mining Engineer the Department was still largely concerned with the mining of gold and coal but as the 1950s neared there was greater emphasis on the exploration for and exploitation of other minerals. PSLs; *WWA*; Spillman, pp.190, 202

### **FRANCIS, Arthur J.**

Francis was the manager of Hannan's Star GMS Ltd (ECGF Boulder) in 1908 and 1909, when the mine was being jointly worked with Boulder Deep Levels Ltd, managed by H.E. Vail (q.v.), before the two mines were amalgamated in 1909 to form Hannan's Star Consolidated Ltd. In 1911 Francis was the general manager for Hampton Uruguay Ltd at the Lady Miller lease (both DGF), south-east of Norseman and was manager of Brown Hill Extended Ltd (ECGF Boulder) from 1912 to 1918. In 1919 he returned to Hampton Uruguay mine which closed down in the same year. This mine paid three dividends



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in 1903 and 1904. During the 1920s Francis was manager of Hampton Properties Ltd. (ECGF) which owned Hampton Plains Blocks 45 and 50, near Feysville. He was a member of the WA Chamber of Mines between 1930 and 1935.

*JCMWA* 1908, 1920; *RICA* 1913, p.237; Skinner 1915

**FRASER**, Alexander MAusIMM. (c.1880-c.1966)

After studying at the Ballarat School of Mines, Fraser worked for several years in Victoria as a metal broker before moving to Western Australia. In Kalgoorlie he worked as the metallurgist for Great Boulder Proprietary Gold Mines Ltd (ECGF Boulder) for thirty-one years from 1903 until 1934 under two managers, Richard Hamilton and John Warrick (both q.v.). He was elected a member of the Australasian Institute of Mining Engineers in 1909 and gave evidence to the Royal Commission on Mining in 1925. After he left Great Boulder he was the metallurgist at Youanmi GMs Ltd (EMGF Black Range) in 1937. He was in Cottesloe in 1961.

Clark Lxvii. *JCMWA* 1909, 1920; *CMWA* 1939; Hooper p.141; *ArcAusMM*

**FREEMAN**, C.C.

In 1910 Freeman was at Great Fingall Consolidated Ltd (MGF Day Dawn), under G.C. Klug (q.v.), where he was employed by Bewick Moreing & Co., mining consultants and mine managers. From Great Fingall's peak annual production of 160 thousand fine oz in 1905, which was the largest quantity of gold produced by any WA mine in that year, production had slumped to 45 thousand fine oz in 1910. Closure seemed imminent until 1914 when the mine was the first in Australia to introduce gold separation by continuous counter-current decantation, instead of the batch-operated vacuum filtration usually used by Bewick Moreing. The innovation staved off closure for another six years. Freeman moved to Lake View Consols (ECGF Boulder) in 1911 and, after the mine had amalgamated with Hannan's Star Consolidated, he worked for the new company Lake View and Star Ltd under H.E. Vail (q.v.). In 1909 Freeman registered Commonwealth Patent 15721 for 'grinding pan discharge and classifier' which he renewed in 1916

*JCMWA* 1910-12; *RH. Kalg* ch.8-4 Patent Register of W.G. Manners (1904-1925)

## G

**GARDE**, Henry Thomas BE, MAusIMM, MIMS (b. c. 1871)

After graduating in mining and metallurgy from Sydney University in 1902, Garde worked at the Central Mine in Broken Hill, at the Great Cobar mine in Cobar, and at Wellington Mines Ltd. After two years as assistant surveyor at Great Boulder Perseverance GML (ECGF Boulder), and nine months as surveyor at the Westralia and East Extension Mines at Bonnievale (CGF), Garde was surveyor at Great Boulder Perseverance from 1907 until 1919. He was elected a member of the Australasian Institute of Mining Engineers in 1913 and was in Broken Hill in 1920 and at Barmera, South Australia, in 1925, where he was resident engineer on irrigation works. He gave evidence to the South Australian Select Committees on Public Works on the drainage of Puddleton Lake in 1938, and also of the Upper Murray in 1941.

*ArcAusMM*.

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**GARDINER**, Beauchamp Lennox CBE, BSc, FSASM, MIMM. (c.1883-1956)

After an education at Adelaide University from which he graduated BSc in 1902 and at the SA School of Mines where he obtained a diploma in metallurgy, Gardiner became mining surveyor and metallurgist at Great Tower Hill GM (MMGF) at Leonora in 1905. He joined Bewick Moreing and Company, mine managers, and worked at Bellevue Ltd (EMGF) at Sir Samuel in 1908 and at the Sons of Gwalia Ltd (MMGF Leonora) in 1911. He moved to Rhodesia in 1911, and returned to Australia in 1950.

JCMWA 1909, 1911

**GIBBONS**, Leo Peter Joseph MAusIMM. (b. c.1900)

Gibbons was educated at Christian Brothers College in Perth and at the WA School of Mines where he studied mining surveying. In 1922 he joined Ivanhoe Gold Corporation (ECGF Boulder) and in 1924 he was appointed chief surveyor for the Pahang Mine in Malaya and, in 1928, for a tin mine in the Malay States. He returned to Western Australia to become superintendent of the Darling Range Quarries in 1929 and joined Lake View and Star Ltd (ECGF Boulder) to supervise special developments in the mine in 1932. He became an Inspector of Mines at Kalgoorlie in 1933 and was elected a member of the Australasian Institute of Mining and Metallurgy in 1934. He resigned from the Mines Department in 1936 to become general manager of Gold Mines of Papua on Missima Island. After returning to Western Australia as mining superintendent of Tindall's Gold Mine (CGF) near Coolgardie, he joined Australian Mines Management and Secretariat as chief mining engineer in 1939. He worked at Consolidated GMs of Coolgardie (CGF) when this was being opened in 1939, and was a member of the Executive Council of the WA Chamber of Mines between 1939 and 1943.

MCER Dec 1935, Apr 1938, July 1939; CMWA 1939, 1943. ArcAusMM

**GLEISBERG**, Robert Bruno

Gleisberg was manager of Lady Loch GM Ltd (CGF) at Coolgardie from 1897 to May 1901 when he resigned. Shortly afterwards he was appointed assistant manager of Associated Gold Mines of Western Australia Ltd. (ECGF Boulder) but did not take up his position until July 1902. In 1902 Associated was in a difficult position. A bear run on the company's shares in 1899 bankrupted Horatio Bottomley, the notorious share manipulator, who consequently lost control of the company to another entrepreneur, Herman Landau. Landau dismissed the mine's manager, W.A. Irwin, in early 1901, replacing him with Thomas Hewitson (q.v.), an experienced reliable manager, who took control of the mine. Improvements were made to the cyaniding process and the roasting furnaces. Cyanide percolation was replaced by agitation with cyanide and filter pressing. The roofs of the furnaces were lowered to improve roasting and fuel economy. The extraction rate gradually crept up past the 70 per cent mark but major improvements were impossible until more suitable roasters were installed. Hewitson retired as manager in November 1902 and was succeeded by Gleisberg. The average annual gold output during the 1900s was 60 thousand fine ounces which was the seventh highest in the state. In 1904 P.Ledoux (q.v.), a Belgian director of the company, during an inspection of the mine, discharged Gleisberg as manager and took over the management himself until 1907, when G.M. Roberts (q.v.) was appointed manager. Gleisberg was a member of the committee which recommended the establishment of a Western Australian school of mines in 1902 and he gave evidence to the Royal Commission on Ventilation and Sanitation in Mines in 1905.

GG 1897, p.2093; Skinner 1897-1904; WAGFC 27 March 1897; WArg 2 Sept 1902; RDM 1902, p.55; Reid pp.262, 275, 279; JCMWA 1903, 1904; RH Kalg ch. 4.3.

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**GODDEN**, Frederick William Ross MBE, MAusIMM. (1886-1962)

After serving an apprenticeship at Great Boulder Perseverance mine (ECGF Boulder) from 1901, Godden was self-employed as a draughtsman and surveyor in 1908. He became a tribute foreman at the Kalgoorlie Amalgamated mine (ECGF Kalgoorlie) in 1909 and was an assistant to the lecturer in Geology at the WA School of Mines, Kalgoorlie, in 1910. He was senior assistant surveyor at Ivanhoe Gold Corporation (ECGF Boulder) in 1910 and was elected an associate member of the Australasian Institute of Mining Engineers in 1911 (and a member in 1915). He was the senior surveyor at the Ivanhoe mine in 1914 and received a mine surveyor's certificate from the WA School of Mines in the same year. Godden was working at Hampton Plains Block 50 in 1921 and was at Woods Point in Victoria in 1924 and at Reefion Gold Mine in New Zealand in 1925. In 1934 he joined Placer Development Ltd. in New Guinea and became General Manager of Loloma Development (Fiji) in 1936. After supervising drilling on the lease of Bulolo Gold Dredge Ltd in New Guinea he became a director and general manager of that company. In 1947 he was a director of another New Guinea company, Golden Dump Development Ltd. He was a member of the council of the Australasian Institute of Mining and Metallurgy in 1955, and was elected a senior member of the Institute in the same year.

*WArg* 30 March 1920; *RDM* 1920, p.104; *MCER* Feb 1936, Apr 1954; *WWA* 1947, 1959; *ArcAusMM*

**GOLDSTEIN**, Selwyn MAusIME (1873-1917)

Educated at Melbourne Grammar School, Goldstein trained as a mining engineer at Broken Hill, and then worked at the Long Tunnel mine at Walhalla and at the South German mine in Maldon. In 1897 he was manager of the cyanide works at the Volunteer mine at Lefroy in Tasmania and in the following year held a similar position at another cyanide works in Victoria. He then moved to Western Australia and for eight years was manager of Great Boulder No.1 Ltd (ECGF Boulder), during the last two years of which he also held the position of metallurgist at Great Boulder Proprietary Gold Mines Ltd (ECGF). He was elected a member of the Australasian Institute of Mining Engineers in 1901. In 1907 he was appointed manager of Mt Cattlin Copper Mining Co. Ltd (PRGF Ravensthorpe) when its parent company, Phillips River Gold and Copper Co. floated it as a separate public company. Goldstein left a year later to go to London where he worked for several months reporting on mines before being appointed manager of the Tominil silver mine in Mexico. He was elected a member of the Institution of Mining and Metallurgy in 1909. After working for about three years in Mexico he returned to London where he undertook work as a consulting engineer during the course of which he visited Portugal, Asia Minor and Honduras. He received a commission in the Royal Engineers in 1915 and was killed in action in France in June 1917.

Clark pp.28, 40; *WAMBEJ* 19 Jan 1907; *JCMWA* 1908; Reid p.268; Quartermaine. PRGF; *ArcAusMM*; *TIMM* 27(1917-18)

**GRAY**, George

Gray was manager of Hannan's Proprietary Development Co Ltd (ECGF Boulder/Kalgoorlie) in 1895 when, with H.J. Saunders (q.v.), he proposed a scheme to supply water to Coolgardie and Kalgoorlie by pumping from Northam. In August 1895 he was a founder member of the Kalgoorlie Stoke Exchange. In March 1896 he floated Hannan's Central and another lease in London as the Lake and Boulder Junction GM. As the attorney for Associated GMs of WA Ltd (ECGF Boulder) Gray appointed W.A. Irwin (q.v.) manager of the mine in September 1896. When the Governor, Sir Gerald Smith and Lady Smith, visited Kalgoorlie in the same month, Mr and Mrs Gray entertained the Vice-regal party at a dinner, concert and dance. In 1897 Gray was general manager of the following gold mines: Corsair Consolidated (21 leases, 5 miles east of Great Boulder), Hannans Golden Pebbles, Hannans Golden Pike, and Lake View East (south of Lake View Consols).

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(None of these mines produced any significant amounts of gold.) Gray was also the resident engineer in Western Australia for Colonial Finance Company. He returned to England in January 1897.

WArg 19 Sept 1895 p.5, 26 Sept 1895 p.5; Skinner 1897 pp.89, 101,178, 234; Reid pp.198, 210, 217, 233, 249.

### **GRAYSON, Lawrence William**

Grayson was the metallurgist at Associated Gold Mines of Western Australia Ltd (ECGF Boulder) from 1897 to 1900. During most of this period the company was controlled by Horatio Bottomley, the promoter and financier who in 1899 was boosting production at the mine by sending rich ore to smelters in the eastern states. In May 1898 the company was only the second in Kalgoorlie-Boulder to announce that it intended to build a sulphide ore processing plant. This would utilise the 'dry crush and roast' process advocated by Alfred James (q.v.), the British metallurgist. Grayson carried out tests which confirmed the soundness of this proposal. He then built a pilot plant to simulate the intended plant, using machinery already on site. The pilot plant worked intermittently from July 1898 to September 1899 but was of little use for testing the proposed plant because the roaster was thoroughly unsatisfactory. Failures in its operation, however, should have warned the company and others intending to use roasters of the problems of cyaniding poorly roasted ore. The full scale plant started in September 1898 but, again, the roasting and cyanide percolation were inadequate. Gold extraction rates from the pilot plant and from the full scale plant, which Grayson quoted in a paper to the Australasian Institute of Mining Engineers in 1901, were almost 20% higher than the most likely levels, as was pointed out by Grayson's successor. The high rates were probably the ones which Bottomley had quoted in London and Grayson chose to perpetuate the fiction. His testing procedure with the pilot plant could have been of much greater value had the results of the trials been applied to the operation of the full scale plant. The secrecy which was endemic among the Boulder mines in the early days of sulphide processing was reflected by the roasted ore in the cyanide percolation vats of both Great Boulder Main Reef and Lake View Consols setting solid in plaster of Paris in 1899, just as it had in Grayson's pilot plant a year earlier. Bottomley was bankrupted by the bears in 1899 and another speculative financier, Herman Landau, took control of Associated Gold Mines, changed the mine manager and commissioned reports on the mine by British consultants. Grayson resigned in February 1900.

His papers include: 'The metallurgical treatment of the sulpho-telluride ores of Kalgoorlie, with special reference to experiments conducted and sulphide mill erected on the Associated Gold Mines of Western Australia Limited', *ProcAusIME* 7(1901), p.181.

RH. Kalg ch. 4.3; Sykes pp.312-20

### **GREENHILL, Thomas Warren** MIMS (b.c.1886)

Greenhill arrived in Western Australia in 1904 and working as a surveyor at South Kalgurli GMs Ltd (ECGF Boulder). He was a foundation member of the Institute of Mine Surveyors in 1916. He pegged the Enterprise lease (ECGF Boulder) on the western side of the South Kalgurli lease. The former was developed into BHP's Kalgoorlie Enterprise Mines (1934). Greenhill was the underground manager of Oroya Links Ltd (ECGF Boulder/Kalgoorlie) from 1920 until 1928 when the mine closed. He was manager of the Paringa Mining and Exploration Company (ECGF Kalgoorlie) from 1934 and also of the Golden Horseshoe sand retreatment project from 1936 which for twenty years produced an annual average of 10 thousand fine oz of gold. In 1940 he was a director of the Golden Bounty Syndicate Ltd.(CGF) which had a small mine at Kunanalling. He retired in 1949 after selling his mining interests to Gold Mines of Kalgoorlie.

CMWA 1939, 1942; MYBA 1951; Lloyd p.73

## WESTRALIAN FOUNDERS OF 20<sup>TH</sup> CENTURY MINING

### **GRIFFITH, E.A.**

In 1901 Griffith represented Hannan's Associated Ms on the Chamber of Mines of WA. From 1901 to 1903 he was manager of Fingalls Pty Ltd at Cashmans in Broad Arrow Goldfield. The mine was on the same ground as the former Lady Evelyn GMs Ltd (1897-1900). Fingalls Pty produced 408 fine oz from 174 tons of ore while operating in 1902-03. From August 1903 to March 1904 Griffith was manager of Paringa Mines Ltd (ECGF Boulder/Kalgoorlie) which had a lease in the centre of the Golden Mile (on the north side of the Iron Duke lease of Associated Northern) and other non-contiguous leases. It operated until 1912 and in 1903 produced 840 fine oz of gold from 500 tons of ore. From 1904 until 1906 Griffith was manager of North Western Associated GMs (WA) Ltd (ECGF Kalgoorlie) which held two leases on the north-eastern side of the Golden Mile. The company was wound up in 1906.

Skinner 1897, 1906; *JCMWA* 1901-06

### **GRIGG, J.**

Grigg was one of the mine superintendents employed by Bewick Moreing & Co. to supervise mines which the company was contracted to manage. From January 1908 to the end of 1910 Grigg was manager of Vivien GMG Co Ltd (EMGF) which was ten miles north of Lawlers. It was formed by Bewick Moreing in 1902 after the mine had been acquired by Bewick Moreing's agency company, London & WA Exploration Co Ltd. It started production in 1903. Grigg was its last manager as it closed in 1912, having produced 76 thousand fine oz of gold from 209 thousand tons of ore. From 1911 until the end of 1912, Grigg managed the Northern Mines Ltd (EMGF) which had a central crushing plant at Lawlers (formerly part of East Murchison United mine) which was connected by a steam tramway in a northern direction to two mines at Waroonga which provided most of Northern Mines' ore. When the mines became uneconomic they were closed and Grigg had to close down another mining complex. In 1906 Grigg registered provisional Commonwealth Patent 6952 for 'a process of separating oils from boiler feed water' which he did not complete.

In 1911 Bewick Moreing employed 14 superintendents (mine managers) in Western Australia at mines which it managed. They were paid in nine grades, according to their experience, capability and usefulness to the company, from £150 per month (grade 1) to £30 per month (grade 9). The highest paid was John McDermott (grade 1) who managed the Sons of Gwalia (MMGF Leonora). Grigg was grade 4, paid at £83-6s-8d per month (or £1,000 per year). There were four men at grade 2 (£125 per month) and one at grade 3 (£100).

Skinner 1902, 1910, 1912; Bewick Moreing 1911 staff data (courtesy Prof Limbaugh Dec. 2000); *JCMWA* 1908-12; Patent Register of W.G. Manners (1904-25)

### **GRUT, Charles Frederick de Jersey BA, BE, MIMM (1872-1921)**

After graduating from Oxford University (BA in 1895) and from Sydney University (BE in 1901), Grut spent a year in the American mining industry at Butte, Montana. He returned to Australia to work in mining in northern Queensland, before moving to Kalgoorlie in 1903. He formed a partnership with R.A. Black (q.v.) and T. Blatchford (q.v.) in 1904 as mining consultant, mineralogist and assayer. He continued as a principal of this company until 1920. He represented the Sandstone Development GM Company (EMGF Black Range, Sandstone) in the WA Chamber of Mines between 1907 and 1911 and also Hannan's Reward Ltd (ECGF Kalgoorlie) between 1912 and 1920, and designed and constructed a number of treatment plants. After working in the explosives industry in England between 1914 and 1917, he was at North Kalgurli (1912) Ltd in 1920. He died in 1921.

*JCMWA* 1905, 1913, 1917, 1921; *TIMM* 32, 1922-23, p.288

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### **GUNTHER**, Edward

Gunther was a German engineer employed by Krupp Grusonwerk prior to 1897. In December 1896 an Anglo-German group, the Anglo-Continental Gold Syndicate, contracted to erect at Hannan's Brownhill GM Co.(ECGF Kalgoorlie) an oxidised ore treatment plant in exchange for Brownhill shares. The plant was to incorporate the Pape-Henneberg process invented by Herman Pape in conjunction with metallurgists Carl Gopner and Ludwig Diehl (q.v.). The bulk of the plant was manufactured by Krupp Grusonwerk and was shipped out to Western Australia in June-July 1897, accompanied by Gunther, Pape and Diehl. The Anglo-Continental Gold Syndicate's work in Australia was undertaken by its subsidiary, London and Hamburg Gold Recovery Company, of which Gunther was chief engineer and Diehl its chief chemist. The erection of the oxidised treatment plant was supervised by Pape and Gunther but took over a year to complete. The Pape Henneberg process must have been ineffective as it was no longer mentioned and the only non-standard part of the completed oxidised ore treatment was the cyaniding of the fine sands and slimes with both potassium cyanide and bromocyanide. Gunther worked with Dr. Diehl (q.v.) to construct and commission the Diehl treatment plants for processing sulpho-telluride ores at Hannan's Star GMs, Lake View Consols and Hannan's Brownhill in 1900 and 1901. Gunther was the representative of the Gold Recovery Company in Western Australia until 1907.

GG 1897, p.1712; *WArg* 19 Jan1899 p.24; Skinner 1903 p.132, 1905 p.121; *JCMWA* 1902, 1907; RH.Kalg ch 5.3

## H

### **HACK**, Ernest Barton ASASM, MAusIME (b.c.1867)

Born in South Australia and educated at Prince Alfred College and at the SA School of Mines, Hack joined the mining industry in 1891. He moved to Kalgoorlie where he was engaged in the erection of gold ore treatment plants at the Golden Horseshoe, Great Boulder Perseverance, Associated Gold Mines, Great Boulder Main Reef and Kalgurli gold mines. He was elected a member of the Australasian Institute of Mining Engineers in 1901. He spent two years in the United States during which he was employed as chief engineer for the Union Pacific Coal Company in Wyoming and also visited mines in Nicaragua. On his return to Australia in 1909 he was appointed assistant construction manager for the De Bavay Company in Broken Hill and worked on the development of the flotation process.

His published papers include: 'Coal mining in Wyoming' *MER* Feb 1909, pp.145-49.

*ArcAusMM* *MER* May 1909, p.243

### **HALL**, George William JP

Hall was born in Herefordshire, England, and was educated at Staunton and privately. He worked as an underground miner in both coal and hard rock mines before studying geology and lecturing on the subject in South Wales and London. He was interested in political reform and edited the reformist newspaper the *Cambria Daily Leader*. In the late 1880s he became associated with the mining enterprises of financier, Pritchard Morgan, particularly ones involving the revival of the gold mining industry in Wales. Subsequently he became a partner in the company, W. Pritchard Morgan and Co. and acted as consulting engineer to the companies formed by Morgan. In 1895 Pritchard Morgan and Hall travelled to Western Australia with the intention of establishing gold mines in that colony. Morgan, in the name of his agency company, London and Westralian Mines and Finance Agency Ltd or its stablemate, British Westralian Mines and Share Corporation Ltd, took out options over about twenty different embryonic mines, mostly in the Mount Margaret Goldfield, a field which had not yet been extensively prospected. Hall then inspected the prospects and determined whether they had potential for

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development as mines owned by individual public companies. Hall and his associate, Alexander Castle (q.v.), who was usually responsible for establishing the infrastructure required for a mine site, established their headquarters at Malcolm where Hall's first mine, the North Star GM (MMGF), was located. Hall's inspections were in a large area covering most of the Mount Margaret and East Murchison Goldfields. The most important of his acquisitions was the Sons of Gwalia mine at Leonora which he inspected at the end of 1896 and purchased from Thomas Tobias, the Coolgardie storekeeper who had 'grubstaked' the prospectors who had found the outcrop. After a head frame and battery had been erected, Edward Hooper (q.v.), the Western Australian resident partner of Bewick Moreing and Co., visited the mine and instructed Herbert Hoover (q.v.), Bewick Moreing's inspecting engineer, to make a thorough inspection of the mine. Hoover reported favourably on it and the firm's agency company, London & Western Australian Exploration, purchased the mine and it was later floated on the London Stock Exchange as the Sons of Gwalia Ltd. Hoover became Bewick Moreing's first manager of the mine. Castle and most of his staff moved to the Star of Gwalia mine which had been started on one of the leases which Hall had pegged to the south of the Sons of Gwalia. The mine was not a success and most the staff moved to other mines run by Hall. In August 1898 Hall purchased some leases at a prospect six miles south of Laverton (MMGF Mt Margaret) and floated it in London as Euro GMs Ltd. The mine was operated for six years and produced 18.8 thousand fine oz.

In 1901 and 1902 Hall inspected mining prospects in the East Murchison Goldfield and in February 1902 he purchased two mines at Wiluna, the Essex and Violet mines. They were floated as Gwalia Consolidated and Castle moved to Wiluna to manage the mine. However he fell ill and died in 1905. The mine was worked until 1910 when the arsenopyrite in the sulphide ores proved uneconomical to treat by conventional means. After several other attempts at working the mine the remaining assets were bought by Claude de Bernales (q.v.) who floated Wiluna Gold Corporation in London. Subsequently, Wiluna Gold Mines Ltd was formed to operate the mine and the flotation process was successfully adapted to treat its ore. Remarkably, George Hall was responsible for founding two of the most successful Western Australian mines outside Kalgoorlie, the Sons of Gwalia and Wiluna Gold Corporation. Hall returned to Wales and died in an accident.

*WArg* 30 March 1899, 5 Jul 1900; *Skinner* 1899,1900; *JCMWA* 1902; *GG* 1902, p.1349; *G. Beresford OH, Battye Lib; Thiel* pp.329-30; *JHSWA* v4 pt2 1950, pp.57-59

### **HALL**, William Leslie Reid MAusIME

Hall worked at the Bendigo Consolidated and Great Southern mines in Victoria before spending two years in railway construction and returning to mining in 1886. He was elected a member of the Australasian Institute of Mining Engineers in 1901. In Western Australia in 1903, he was manager of Peak Hill Goldfield Ltd (PHGF) which was an open-cut mine in a large leased area between the Gascoyne and Murchison Rivers. In 1903 the mine produced its highest annual gold production of 35 thousand bullion ounces which was the fourteenth highest of any mine in the state and the fifth highest for a mine outside Kalgoorlie. In every year between 1898 and 1905 the mine produced over 15 thousand bullion ounces. In 1903-04 Hall also managed Horseshoe (Peak Hill) Goldfield Ltd (PHGF) which in its short life of only one year produced only 605 fine oz (though the yield was 4.4 ounces per ton). In the same year he managed Lake Way Goldfields (1899) Ltd (EMGF Wiluna), a mine which had looked promising for a long time but which only produced 7960 fine ounces in the six years to 1906. Hall gave evidence to the Royal Commission on Ventilation and Sanitation of Mines in 1905 and was a member of the Board of Conciliation for the Western Industrial District in 1904-05.

*WArg* 1 Sept 1902; *JCMWA* 1903, 1904; *Skinner* 1904, 1906; *WAMBEJ* 30 July 1904 p.5; *ArcAusMM*

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**HAMILTON**, Richard ABendSM, MIMM, MIMMAmer, MAusIMM

(1855-1943)

Hamilton was born at Williamstown, Victoria, and educated at Bendigo High School and Bendigo School of Mines where he studied metallurgy and gained a mine manager's certificate. He worked for the first three years of his training in the office of a Bendigo civil engineer and architect before joining the company of his stepfather, F. Clark, and acting as his assistant in managing his gold ore treatment works at Eaglehawk. In 1883 he became manager of the British-owned Honnali GMG Co, in the Shimoga district of Mysore in India, where he was responsible for two mines, the Honnali and the Palavanahalli. The reefs being mined were narrow and the company closed down at the end of 1885. He returned to Australia via Britain and was appointed manager of Peel River Pty GMS, a recently opened mine at Bowling Alley Point, not far from Tamworth, NSW. Despite the development of underground and surface works a drought prevented any crushing for several years. Hamilton left in 1889 to concentrate on the development of a fruit farm in the Goulburn Valley. However, the depression in the eastern states reduced his anticipated income from the farm and, in 1893, he accepted the position of manager of the Tuscon Mining and Smelting Co. in Arizona, USA. The offer had come through W.M. Murray of Adelaide who was associated with the management of both the Peel River Co. and the Tuscon Co. The copper mine Hamilton managed was a small producer with a troublesome smelter but was one of a number in the same district which he was able to inspect. He was impressed more by American labour laws than by its technology. When on leave from Arizona, in Eaglehawk in 1895, he accepted an offer of the management of the Great Boulder Pty GMS Ltd (ECGF Boulder) at Kalgoorlie. He had been recommended by Zebina Lane (q.v.), the engineer manager and attorney of Great Boulder Pty (GBP) who had helped float the company in London and had been a boyhood friend of Hamilton in Bendigo. Hamilton signed a three year contract to manage GBP and its neighbour Great Boulder No.1 and arrived in Kalgoorlie in January 1896. Ore treatment at GBP had started in April 1895 and by the end of the year 26,663 oz (bullion) had been produced at a yield of 6 oz 4 dwt per ton and the company had paid a 100 per cent dividend for the year. To prevent major variations in production Hamilton kept one third of each month's gold production in reserve. C. Kaufman (q.v.), Whitaker Wright's Australian manager, offered Hamilton the management of Lake View Consols (ECGF Boulder) in 1896 and of Ivanhoe Corporation (ECGF Boulder) in 1897 but Hamilton declined both because of his existing contract with GBP. In 1896 he shared a house in Coolgardie with Frank Wittenoom (q.v.), a pastoralist whom Lane had invited to be manager of Great Boulder Perseverance (ECGF Boulder) the lease of which shared a boundary with GBP. Hamilton was Perseverance's supervising engineer and advisor to Wittenoom. Hamilton and Wittenoom moved to Boulder when the managers' houses on the two mines were built. Lane retained the power of attorney for GBP for over two years during which time Hamilton was required to refer major financial matters to him. In October 1897 Hamilton travelled to the South German GM Co at Maldon in Victoria for a trial treatment of GBP slimes. He also inspected Victorian roasting furnaces and the tower furnace used at Mt Morgan in Queensland. On his return he was asked to discuss roasters with other Boulder managers but was disappointed to find that they preferred American furnaces to Australian ones. In December 1897 John Waddington, a GBP director and its largest shareholder, visited Kalgoorlie and asked Hamilton to inspect properties at Kanowna and Kalgoorlie. Waddington also asked him to visit properties in the Mt Margaret GF where he inspected 23 gold properties and several copper ones in mid-January on a long hot journey by camel. Waddington offered him a good salary to leave GBP to inspect properties for him but he declined, commenting to a South Australian friend, 'I do not think that my talents lie in making reports to float companies, as I do not lie fluently'.

When Hamilton returned from the Eastern states in December 1897 he learnt that on the advice of Lane and GBP's consultants, John Taylor & Sons, the GBP Board had signed a contract with Boulder Milling Company (BMC), a company formed by an American, C. Koneman (q.v.), for BMC to treat Great Boulder's oxidised ore tailings and its sulphide ore



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using a patented process devised by Koneman. From the information which he initially received, Hamilton thought the terms of the agreement were far too generous to BMC particularly in relation to the treatment of existing tailings. He wrote angry letters to Waddington and the GBP secretary before he discovered that GBP was a 50 per cent partner in BMC. Under the contract GBP was only required to accept the BMC plant if it was at least as effective as those of GBP's neighbours. Koneman arrived in May 1898. The BMC process had six principal stages all of which involved non-standard treatments and equipment. One clear advantage was that ore for the roaster had only to be crushed to 'hazel-nut' size so fine crushing which was used in the other processes being developed was not required. After the 'unqualified success' of the gas-fired roaster in November 1898 Hamilton was enthusiastic about the process and told the chairman of GBP directors that he could see Koneman's process being 20s per ton cheaper than those adopted by his neighbours. Koneman and Hamilton then spent two very stressful months overcoming one difficulty after another in all of the next four stages. At the end of January after several unsuccessful attempts to operate the last problem stage, the compressed air pressure tanks required to extract the gold solution from the waste pulp, Hamilton reluctantly recommended to the GBP board that the Koneman process should be abandoned. Unfortunately, under the agreement with BMC GBP could not use the pulveriser or the roaster. Had Koneman adopted standard filtration and precipitation methods the process might well have approached what Hamilton described to his step father, in November 1898, as 'a revolution in mining'. However, three months later he told Waddington, 'I do not want any more untried processes. The risks are too great'.<sup>1</sup> As a result of the failure of the Koneman process both Lane and Jon Taylor & Sons lost their positions with GBP and Hamilton found himself in a far stronger position and was able to implement his own plans for treating the mine's sulpho-telluride ore. His process was similar to the 'dry crush and roast' process first installed by Marriner (q.v.) at Great Boulder Main Reef (ECGF Boulder) which became the standard process used by the majority of Kalgoorlie mines. In 1896 Hamilton had been very critical of the early dry crushing plants because of the hazard which workers faced from their extremely dusty working areas. Despite his earlier misgivings he had to adopt dry fine crushing as a necessary preliminary to roasting. Full enclosure of crushers, elevators and conveyors was provided, together with fans and other installations to collect the dust.

During the eight month delay caused by the Koneman work, Hamilton was able to assess the effectiveness of the different roasters in Kalgoorlie and what was available elsewhere. It was an important choice as in the early sulphide plants effective roasting was the most critical factor. He confirmed his original opinion that the only, large capacity, economical, roaster was the Victorian Edwards furnace. It was a long line reverberating furnace with L shaped rabbles passing through the roof of the furnace and had a largely prefabricated casing which could be assembled quickly at a mine. A trial roasting of GBP ore in Ballarat was successful although supplementary firing was considered necessary. Twelve furnaces were installed at GBP which were the first Edwards furnaces to be used in Kalgoorlie. Most were gas-fired but a number were timber-fired for cost comparisons. Timber-firing proved the more economical and the gas-fired roasters were converted to timber-firing. By 1902 GBP extraction rates from sulpho-telluride ore (averaging 35 dwt per ton) were 93-95 per cent which was very high by international standards although treatment costs were still high. Roasting by the Edwards furnaces was still far from perfect so when additional roasters were required in 1902 a trial roasting of GBP ore by the Merton furnace at Spotswood in Melbourne was held. The trial was successful and six Merton furnaces became operation at GBP in early 1903. The Merton furnace had three hearths positioned over each other and the ore was moved along them by vertical rabbles, countercyclically to the combustion gases. The furnace's advantages were its compactness and the greater control over the roasting process. It gradually lost favour in Kalgoorlie, however, and when Hamilton required more roasters in

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<sup>1</sup> Underlining by Hamilton.

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1907 he chose an improved version of the Edwards furnace, the Duplex furnace, which had double the number of rabbles that the first version had and which became the new standard for Kalgoorlie.

In the GBP sulphide plant to remove the gold solution from the cyanided pulp Hamilton used filter presses into which the pulp was pumped. These were very labour intensive to use so in January 1906 the GBP engineer, G. Ridgway (q.v.), established a prototype vacuum filter machine in which the pulp was sucked onto the filters. Ridgway's patented vacuum filter was an automated continuous flow machine unlike any other in use. In the mining press it was heralded as being the most efficient on the market and after a year's trouble free operation Hamilton ordered a further ten to replace the filter presses.

Hamilton was elected President of the Australasian Institute of Mining Engineers in 1909 when its annual conference was held in Kalgoorlie. He was vice-president in the following three years and served on the Institutional Council from 1913 to 1925. He was elected a member of the American Institute of Mining Engineers in 1898 and was President of the Western Australian Chamber of Mines from 1901 to 1943.

In 1915, Hamilton, G. Ridgway and F.A. Moss (qq.v.) formed a syndicate to purchase the Lancefield gold mine (MMGF), five miles north of Laverton. The syndicate successfully adopted the Kalgoorlie 'dry crush and roast' treatment method to process the mine's refractory arsenopyrite ore. The mine, managed by Moss, operated until 1921 when it closed because of rising costs, having paid £128,000 in dividends. In 1925 Hamilton was a member of a deputation which lobbied Prime Minister Bruce for a Federal gold bonus for which Hamilton prepared the supporting data. Later in 1925 he became a director of Wiluna GMs, the most successful mine of C. de Bernales (q.v.), another supporter of the gold bonus.

In 1926 when the main lode of GBP was apparently exhausted Hamilton reluctantly introduced tributing to the mine. However it allowed the company to convert a loss of £12,000 made in 1926 to a profit of £30,000 in 1927 and also to carry out development work on new lodes. In 1933 Hamilton supported GBP in its successful fight against a take-over bid by Lake View & Star Ltd which had grown to become the largest leaseholder on the Golden Mile. Also in 1933 he became a director of Western Gold Mines NL, a company associated with the Collins House company, Western Mining Corporation. He also became a local director of Triton GM, a company formed to open a mine on leases held by Western Gold at Reedy in the Murchison GF. In 1934 he was invited to become a member of Western Mining Corporation's Western Australian Advisory Committee. In 1935 de Bernales formed Great Boulder Mining & Finance Ltd which took over GBP. Hamilton remained a local director of GBP. It went into voluntary liquidation in 1941.

Hamilton's wife, Kate, died on 23 July 1926. He moved to Perth in January 1927, returning to Kalgoorlie to formally hand over the management of GBP to John Warwick (q.v.) in March 1927. The Chamber of Mines continued to re-elect him President every year until his death with the four vice-presidents taking it in turns to carry out his duties.

In 1899 Hamilton invested in the WA Goldfields Firewood Supply Co (based at Kurrawang) an investment which he retained for the rest of his life. He was a director of Attwood Motors (1934) Ltd, Perpetual Trustees Co. and Metropolitan Mining and Development Company Ltd. in 1942. He died at Cottesloe on 16 March 1943. His published papers include: 'Presidential address: progress of mining in Western Australia' *TAusIME* 13, 1909, pp.7-25.

Skinner 1897, 1909, 1915, 1920; *JCMWA* 1902, 1920; RH.Kalg cp.4.3 & 4.4; Battye 2, p.338; Matters, pp.205-06; *FJA* 1914, p.91; *MER* Aug 1915, p.259; *CEMR* Feb 1937, p.215; Colless p.128; *WWA* 1938, p.231; 'Obit' *ProcAusIMM* 120, Dec 1940, lxxvi; 129, March 1943; Porter, A.E., 'Richard Hamilton' *Stud WA Hist* Dec 1982; *DWAE* 5, p.376; Gibney/Smith 1, p.297; *ArcAusMM*; Porter, A.E., 'Richard Hamilton', thesis, Murd. Uni., 1981; R. Hamilton letter books 1-3 held by the Hamilton family

**HARPER**, Nathaniel White MLA (1865-1954)

Born in Ballymena, Northern Ireland, Harper emigrated to New Zealand in 1883. He worked in hydraulic gold mining in Central Province until 1887 when he moved to Broken Hill. After two years working for Broken Hill Pty Ltd during which

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time he became a mines foreman, he moved to Zeehan in Tasmania where he was manager of the Queen Extended silver and lead mine. In 1892 Harper travelled to Western Australia to become manager of Fraser's GM (YIGF) at Southern Cross. In 1895 he moved to Kanowna where he initially managed Robinson GM (NEGF) and from 1896 until 1903 White Feather Main Reefs Ltd (NECGF). The company was registered in 1894 and reconstructed in 1898. Dividends were paid annually from 1898 to 1904. Peak annual production of 14 thousand oz (bullion) occurred in each of the years 1901-03. Harper then managed Golden Pole GMs NL (NCGF Ularring) at Davyhurst from 1903 to 1910 when the mine had a yield of 19dwt per ton. In 1909 he helped finance the Koh-i-Noor GM Co Ltd (MGF Meekatharra) at Stakewell which operated for two years with a yield of 9dwt per ton.

Harper, a JP, was Mayor of Kanowna from 1897 to 1901. He retired from the goldfields in 1910 and lived in West Perth for the rest of his life. He had a wide range of business interests. He visited Russia in 1915 to inspect gold mining prospects in Siberia and made other overseas investments, notably in South African mines. He bought a farm near Brookton which he ran through a manager and leased a pastoral property, Giralia Station near Exmouth Gulf. He also invested in property in Perth. While still at Kanowna, in 1898, he built the Esplanade Hotel, and later, in 1938, 'Harper's Buildings' on Hay and King Streets. He was Liberal MLA for Beverley 1910-11, and for Pingelly 1911-17.

WAGFC 30 March 1895 p.5. WArg 12 Jan 1899, 5 Jul 1900, 21 Oct 1902; Skinner 1900, 1903; CMWA 1902, 1903; Reid p.270; Gervas; Thiel p.646; Bull pp.59, 98; ADB 9; Black & Bolton p.91

**HARRIS**, Charles Marshall ABalSM, MAusIMM, MIMM (1873-1961)

A graduate of the Ballarat School of Mines with certificates in mine surveying and geology, Harris moved to Western Australia in 1891. In February 1892 he joined a prospecting party which followed Hunt's track to Slate's Well and prospected the Hampton Plains area. After working for a time in Southern Cross, Harris and a companion, prospected in the eastern goldfields for nearly two years, following a number of rushes including those to Coolgardie, Goongarrie, Hannan's, Kanowna and Kurnalpi. In 1897 Harris was in charge of a new mine at Bonnievale (CGF) and in 1898 he was appointed manager of Lake View East GM Ltd (ECGF Boulder), a company promoted by Hannan's Proprietary Development Company occupying a lease adjoining Lake View Consols. The following year he became manager of the Development Company which held a group of leases at the northern end of the Golden Mile for development as individual mines. General manager of the leases was Percy J. Ogle & Co, a London mining consultant and mine manager. In 1899 deep alluvial leads of gold ore were discovered on one of the company's leases and alluvial diggers excavated alluvial wash as permitted under the decision made on the Ivanhoe Venture case. The company disputed the diggers' right to the gold and a violent confrontation was only avoided by Harris persuading the company to purchase the stockpiled wash at a price acceptable to the diggers. In 1905 Harris was manager of Queen of the West GM (ECGF Kalgoorlie), a company floated by the Development Company based on one of its northern leases. Harris was elected a member of the Australasian Institute of Mining Engineers in 1901 and acted as its local correspondent and secretary between 1909 and 1912. In 1906 Harris joined Bewick Moreing & Co. for which he became mine surveyor at the Sons of Gwalia Ltd (MMGF Mt Malcolm) and then manager of Bellevue Pty Ltd (EMGF Lawlers) at (Mount) Sir Samuel. Bewick Moreing superseded P.J. Ogle as general manager of Hannan's Pty Development Co. (ECGF) in 1907 and Harris returned to the company as its manager. He moved to Kookynie to manage Cosmopolitan Pty Ltd (NCGF Niagara) in 1907-08 when the mine had one of the lowest working costs in the state. He then worked on his own behalf as an inspecting engineer assessing potential mining prospects before returning to Bewick Moreing to manage Hannan's Pty Ltd again from 1910 to 1913.

Before the First World War Harris was elected a member of the (British) Institution of Mining and Metallurgy and in 1919 he became chairman of its Western Australian committee. That year he represented Western Australia at a conference in

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London of overseas chairmen of the Institution. Shortly after his return he was commissioned by a London consultant to report on several prospects in the Pilbara and Kimberley Goldfields. The main one of interest was the Braeside lead deposit in the Marble Bar area which Harris considered to be too remote to be exploited at the time. Of the four prospects inspected in the Kimberley only Koolan Island iron ore was considered worthy of further investigation. Between 1920 and 1930 Hwas a member of the State Mining Board and also of the Prospecting Board. In 1934 he was manager of the Bird-in-Hand GM at Woodside in South Australia, an old flooded mine which, after major dewatering and reconstruction, was brought back into production. He was in private practice in 1935 and was a director of Westonia Tailings Ltd. During the Second World War Harris was on the underground staff of Great Boulder Pty. He retired in 1947.

Harris wrote a number of articles about the early days of the goldfields under the pen name 'Diorite'. These were rewritten or edited by Malcolm Uren and published as *Glint of Gold*, Robertson & Mullens, Melbourne, 1948. The technical papers and articles written by Harris under his own name include:

- 'The Victorious Mine, Ora Banda, W.A.', *MER* 5, Mar 1913, pp.235-36;
- 'Golden Horseshoe [MGF] development: new plants [at northern mines]', *MER* 5, July 1913, pp.410-12;
- 'Prospecting for gold and other ores in Western Australia', *TIMM* 29, 1919, pp.3-17;
- 'Effects of taxation on the mining industry', *CEMR* 13, June 1921, pp.304-05;
- 'The lead mines at Galena, Northampton, W.A.', *CEMR* 16, Sept 1924, pp.475-77;
- 'Dorham L. Doolette: an appreciation', *CEMR* 18, Jan 1926, p.140;
- 'Nor-West Australia: the Braeside mineral field: lead mining and transport', *CEMR* 18, June 1926, pp.355-58;
- 'Mining & metallurgical practice at Kalgoorlie: improvement at Lake View & Star', *CEMR* 23, Aug 1931, pp.411-14;
- 'The Bird in Hand: unwatering an old South Australian mine', *CEMR* July 1934, pp.389-90;
- 'An unwatering difficulty overcome [Bird in Hand mine]', *CEMR* May 1935, p.270;
- 'The Eastern Goldfields early explorers, 1863-1866: H.M. Lefroy – C.C. Hunt', *JHSWA* 3, Dec 1942, pp.35-37;
- 'In Hunt's tracks', *JHSWA* 3, Dec 1942, pp.37-39;
- 'Early history of the Eastern Goldfields from the records of Greaves and Riseley', *JHSWA* 3, Dec 1943, pp.46-53;
- 'Pioneer women of the Goldfields', *JHSWA* 3, Dec 1944, pp.20-24;
- 'Notes on finds by Western Australian prospectors: Kimberley', *CEMR* Nov 1945, pp.51-54;
- 'Notes on finds by Western Australian prospectors: Yilgarn', *CEMR* Dec 1945, pp.91-94;
- 'The Margaret and the Murchison Goldfields', *JHSWA* 3, Dec 1945, pp.22-29;
- 'Deep alluvial gold leads of Kalgoorlie', *CEMR* May 1946, pp.269-72;
- 'The finding of the Murchison Goldfields as told by the late J.C. Peterkin ...', *JHSWA* 3, Dec 1946, pp.26-29;
- 'Water ... Tragedy and triumph on the Western Australian Goldfields', *JHSWA* 3, Dec 1947, pp.18-26.

Skinner 1900, 1903, 1905; *JCMWA* 1903, 1908, 1911; *KM* 3 Feb 1898; *MER* Dec 1912 p.108, Jan 1917 p.126; *RDM* 1924, pp.43, 65-66; Reid p.255; *WArg* 26 Aug 1901; *ArcAusMM*; Uren pp.46, 101-06, 188-93, 214

**HARRISON**, Hector John. MAusIMM (b.c.1879)

After studying metallurgy at the Bendigo School of Mines, Harrison worked at the pyrites works of Harrison Brothers in Bendigo in 1900. He moved to Western Australia in 1902, where, after working briefly at Ivanhoe Gold Corp, Hainault GM, Great Boulder No1 Ltd. and Great Boulder Pty GMs (all ECGF), he became chief assayer at the Associated GMs of Western Australia (ECGF) in 1903, and its chemist and assistant metallurgist in 1906. He worked in the assay and metallurgical section of the Western Australian Department of Mines in 1908 before returning to Victoria where he worked on the retreatment of several tailings dumps, and became general manager of Bendigo Tailings Company in 1912. He

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joined the AIF in 1915 and, after serving in France, spent nine months studying iron and steel metallurgy in Glasgow and electro-metallurgy in London. On his return to Australia he became assistant flotation metallurgist on the North Mine at Broken Hill in 1920, and was elected a member of the Australasian Institute of Mining and Metallurgy in 1921. He was at Wiluna in 1934.

ArcAusMM

### **HARTMAN**, Thomas Franklin (Frank)

Born in Illinois in the USA, Hartman worked in silver, gold and lead mines in Colorado and other mining states. In 1895 he came to Western Australia where he managed Paddington Consols Ltd (BAGF) which had been launched by the Hon. Mrs Candy and in which the financier Whitaker Wright had taken a major shareholding in 1898. After resigning from the mine's management Hartman became attorney for Charles Kaufman (q.v.) and managed Ivanhoe South Extended GMg Estates Co (ECGF) of which Kaufman was a director. Hartman also managed Kalgoorlie Southern Development (ECGF). The collapse of Wright's companies in 1900 and 1901 adversely affected both Paddington Consols, which closed in 1901, and Wright's most valuable mine, Lake View Consols Ltd. After the resignation of H.C. Callahan (q.v.), the manager of the latter, the new manager, G.W. Mackinnon left for London in November 1900 and Hartman was appointed acting manager. It was a critical time in the mine's operation as the new sulphide ore treatment plant incorporating the Diehl process was being commissioned and efforts were being made to improve the poor performance of the roaster in the older sulphide plant. On Mackinnon's return to Perth he announced his retirement as manager and Hartman was appointed in his place. In January 1901 F.A. Govett, director of Lake View Consols, whose group had taken control of the company on Wright's downfall, arrived in Kalgoorlie. Hartman's resignation was accepted and Govett appointed Bewick Moreing and Co as general manager of the mine. Hartman left for America but returned in August 1902 to resume management of Ivanhoe South Extended. In January 1903 Hartman resigned as manager of this mine as it was taken over by the company Golden Horse-shoe Estates and was run in conjunction with operations of the Golden Horse-shoe.

*WArg* 4 Feb 1897, 5 Jul 1900; *Skinner* 1902; *JCMWA* 1902; Reid pp.258, 269, 277, 283; Thiel p.200; A. Sprake, *The Saga of Paddington's Gold*

### **HAWKINS**, Civiall ASASM

(d.1924)

Hawkins studied at the South Australian School of Mines in Adelaide before moving to Western Australia where he was manager of Ivanhoe Junction GM Co. (ECGF Boulder) from December 1904 until May 1906. In 1908 he was at Barrambie Ranges GM Co. NL (EMGF Black Range) and between 1911 and 1916 he was manager of Great Boulder No. 1 (ECGF Boulder) when the mine was producing an average of 13 thousand fine oz of gold per year. He managed Fenian GMg Syndicate (MGF) at Meekatharra in 1917, Riverina South GMs (NCGF) at Mulline in 1919 and Hampton Celebration (WA) Ltd (CGF) on the Hampton Plains in 1920.

*WAMBEJ* 30 July 1904, p.4; *AMER* Feb 1909, p.169; *JCMWA* 1904-1920; *CMWA* 1924; *WArg* 3 Feb 1920

### **HAY**, Archibald Lewis ABalSM, MAusIMM

(c.1869-1938)

Born in Melbourne and educated at Queens College and the Ballarat School of Mines, Hay was the metallurgist at the Queen Margaret GMgCo (ECGF) at Bulong in 1902. He was mill superintendent of the Hainault GM (ECGF Boulder) under R.S. Black (q.v.) from 1907 until 1912 and was manager of the mine in 1913 when it was amalgamated with the South Kalgurli GMs (ECGF Boulder). He was manager of the Bullfinch Pty Ltd. (YIGF) between 1913 and 1920. He was at the Block 10 Mine on Missima Island off New Guinea in 1921. He moved to Melbourne in 1922 where he lived for the rest of his life. He was elected a member of the Australasian Institute of Mining Engineers in 1909.

*JCMWA* 1908, 1920; *Skinner* 1920; *ProcAusIMM* 95 1922 Xix, 111 1938 Xciv; Reid pp.268-69; ArcAusMM

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### **HENDERSON, William**

Henderson was manager of Queen Margaret GMgCo (ECGF) at Bulong from 1900 to 1904 and was a member of the North-east Coolgardie Roads Board in 1900. In 1905 he moved to Norseman to become manager of Princess Royal Central Mine (DGF) on the Princess Royal reef 6 km north of Norseman and, in 1907, of the principle mine on the reef, Princess Royal GMg Co. At that time Norseman's population was nearing its peak of 17,000 people. Henderson was manager from 1908 to 1920 of Mararoa GM (DGF) on the Mararoa reef just east of Norseman. In 1911 the mine reached its peak annual production of 17 thousand ounces. Henderson was chairman of the Norseman local committee of the Western Australian Chamber of Mines for much of this period.

*WArg* 16 Aug 1900; *JCMWA* 1902, 1920; Skinner 1904; *WAMBEJ* 16 Feb 1907 p.15; RH.Kalg tb 4; G. Ralph, *Central Norseman history*; *MER* June 1915 p.285

### **HEWITSON, Thomas** MAusIME (c.1840-1910)

Born near Durham in England, Hewitson emigrated to Victoria in 1856 and worked in Ballarat, Smythedale, and at the Port Phillip Mine at Clunes. He moved to Western Australia and in 1895 was at the Kinsella Gold Mine at Day Dawn (MGF). In 1896 he was general manager of the Ivanhoe Gold Corporation at Boulder (ECGF) which was refloated by Whitaker Wright, the promoter-financier. In 1899 Hewitson resigned as manager of Ivanhoe in protest against Wright's management practices. In Wright's other valuable mine on the Golden Mile, Lake View Consols, a very rich deposit was discovered in the mine in 1898 and large quantities of this ore were mined in 1899 and sent off site for smelting. The London directors had not been advised of the impending exhaustion of the valuable ore. A 'bear' attack on the shares caused heavy losses in Wright's company, London & Globe Finance Corporation. In January 1900 Hewitson was appointed temporary manager in order to restore public confidence in the operation of the mine when its manager, H.C. Callaghan (q.v.) was recalled to London. Hewitson's temporary position as manager ended in April 1900 when G.W.W. Mackinnon (q.v.) was appointed Lake View's manager. Another valuable Boulder mine, Associated Gold Mines of Western Australia Ltd suffered a similar crisis in 1899. The likely approaching end of ore that was sufficiently valuable for it to be sent off site for smelting was the major cause of a 'bear' run on the company's shares. This caused another notorious share manipulator, Horatio Bottomley, to lose control of the company to another entrepreneur, Herman Landau. The latter dismissed the company's manager and appointed Hewitson as the new manager, a position he held until he retired in 1903 when he was followed as manager by R.B. Gleisberg (q.v.). Hewitson was consulting engineer to the Ivanhoe Gold Corporation until succeeded by Bewick Moreing & Co in 1902. He was also consulting engineer to the Adelaide-formed company Ivanhoe Junction GMg Co NL (ECGF Boulder) in 1905. He gave evidence to the Royal Commission on Mining in 1898 and was a member of the advisory board of the Kalgoorlie Electric Power and Light Company in 1900, a vice-president of the Chamber of Mines in 1901-02, and a commissioner nominated by the employers on the Royal Commission on Ventilation and Sanitation of Mines in 1905. He retired in 1908 and died at Dunedin in New Zealand.

RDM 1895-96; *WAGFC* 25 Jul 1896; Thiel p.200; Skinner 1897, 1902, 1905; *WArg* 2 Aug 1900; *KM* Jan 16, Jan 19 1900; *JCMWA* 1902, 1910; Clark p.76; *MER* Nov 1910; Sykes pp.275-84

### **HILL, Alfred John.** ABalSM, AMAusIME (b.c.1888)

After studying metallurgy and mining at the Ballarat School of Mines and acting as a demonstrator in chemistry at the School, Hill worked at the Edward's Pyrites Works (Ballarat) in 1900. He moved to Western Australia and joined the Moss brothers (q.v.) in the Kalgoorlie Gold Recovery Company (ECGF Kalgoorlie) He was elected a member of the Australasian

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Institute of Mining Engineers in 1901. In 1903 Hill was metallurgist at the Paddington Consols Ltd mine (BAGF) for the general manager, Birbeck Hoffman and Jowett. He subsequently worked this mine on tribute for several years. He was manager, between 1911 and 1915, of the Hampton Uruguay Ltd mine (DGF Norseman) which incorporated the Lady Miller mine, 15 km south of Norseman (DGF), and was also part owner of the Mararoa Extended mine (DGF) and several other leases in the vicinity which were explored with limited success. He opened up and worked a coalmine at Wilga, near Boyup Brook, for two years. In an attempt to revive the mines at Westonia (YIGF) from 1931 he managed Hampton Consols GM, the Lady Edna Leases and the Westonia Leases (all YIGF, Westonia) but obtained only limited quantities of gold. In 1938 he was manager of Kununalling Gold NL (CGF, Kununalling).

CMWA 1912, 1915; Skinner 1915; M.K. Quartermaine, pers. comm. 1991

**HOLDER**, Evan Morecott BSc, FSASM, MAusIMM (c.1888-1966)

After graduating from the University of Adelaide and the SA School of Mines in 1909 Holder joined the Central Mine of the Sulphide Corporation in Broken Hill in 1910. He was elected an associate member of the Australasian Institute of Mining Engineers in the same year. He served in the AIF in 1915-18 and, on his return to Australia, he rejoined the Sulphide Corporation initially prospecting for alunite deposits on the Yorke Peninsula, South Australia. He then spent twelve months with the Broken Hill Geological Survey, returning to the Central Mine as chief surveyor in 1922. After spending some time in England during which he worked in the workshops of Metropolitan Vickers Ltd in Manchester in 1923 and located a mine for the Sulphide Corporation in Wales in 1924, he returned to the Central Mine as chief surveyor and assistant underground manager in 1925. He joined Wiluna Gold Mines Ltd (EMGF Wiluna) as chief surveyor in 1930 and was elected a member of the Australasian Institute of Mining and Metallurgy in 1934. He was assistant manager of the Big Bell Mine (MGF Cue, Cuddingwara) in 1952 and was subsequently general manager. He was at Applecross in 1961.

MCER Jan 1952 p.141, Oct 1952 p.27; CMWA 1956, 1966; ArcAusMM

**HOLLOW**, James T. MIMM

Hollow was recruited in the United Kingdom by Bewick Moreing and Co, mining consultants and mine managers, and in 1896 was manager for the company of Block 45 Hampton Plains Estate Ltd. This was one of the first blocks to be floated from the Hampton Plains Estate which was the only land area on the goldfields on which mineral rights were included in the land title. In 1900 he was manager of Golden Age GM Ltd and Lake Way GM Ltd (both EMGF Wiluna). He managed Hannan's Brownhill GM Co Ltd (ECGF Kalgoorlie) in 1902 and, after the company had been amalgamated with Hannan's Oroya GM Co (Western Australia) Ltd, he was manager of the joint company Oroya Brownhill Co Ltd (ECGF Boulder/Kalgoorlie) in 1903-04. H.C. Hoover (q.v.) was a director of the new company. In 1906 Hollow was general manager of Pigg's Peak Development Company Ltd in Swaziland, South Africa (not a Bewick Moreing posting). Crushing at the Pigg's Peak mine had been suspended at the outbreak of the South African war and was not restarted. Hollow returned to Australia and in 1908 was manager for Bewick Moreing of Great Fingall Consolidated Ltd (MGF) at Day Dawn. In that year the mine produced 82 thousand ounces of gold which was the fourth highest single mine production in the State.

Skinner 1897, 1899, 1900; RH.Kalg tab 4; JCMWA 1902, 1908

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**HOLROYD**, Arthur G. BSc, MAusIME

Holroyd graduated from Melbourne University and studied at Freiberg School of Mines in Germany. On his return to Australia he worked in the ore testing laboratory of Austral Otis. Having moved to Kalgoorlie he operated an assay and metallurgical company, Tinley and Holroyd, in partnership with H.N. Tinley in 1896-97. He was associated with the first identification in Kalgoorlie of telluride gold. Although an investigation into its identification by Dr Malcolm Maclaren, in 1912, determined that Erle Huntley (q.v.) was the first person to make a positive identification on 25 May 1896, Maclaren confirmed that Holroyd had been the first to advise the mining press of the discovery. Richard Eades, manager of Block 45 mine (ECGF) in Kalgoorlie, on 27 May 1897, sent samples from the mine which had high gold assays to Holroyd for identification. With the help of Peter Macintyre (q.v.), Holroyd carried out tests in his laboratory which proved the existence of telluride gold and on 29 May he advised the press. Holroyd's letter was published in the *Kalgoorlie Miner* on 1 June. Holroyd was the metallurgist and the curator of the Mineral Collection at the Coolgardie Exhibition in 1899. He was elected a member of the Australasian Institute of Mining Engineers in 1894. He was the correspondent of the Institute in Kalgoorlie in 1897 and was a member of its council between 1896 and 1899. He visited the Paris and Glasgow exhibitions in 1900 and 1901 with the mineral collection. In 1905 he was in partnership with H. Rowley (q.v.). His published papers include 'Discovery of telluride ore' *Aust Min Std*, 1896 xii (401), p.1180; and 'The discovery and occurrence of telluride gold ... Kalgoorlie Goldfield' *TAIME* iv, 1897, pp.186-93.

*WAMBEJ* 21 Jan 1905; *MMg* July 1912, pp.41-42; Reid pp.213, 225; *MCER* Aug 1956, p.348; *ArcAusMM*; RH. Kalg cp 2.2

**HOOKER**, Brian Harvey Hodgson ARSM. (1860-1932)

Born in Kew, London, the son of the director of Kew Gardens, Hooker studied at the Royal School of Mines in London from 1878 to 1881 and then in Germany at the Clausthal School of Mines (1881-82) and the Freiburg School of Mines (1883) before working as manager of the Grube Elisa Mine in Alsace from 1883. In 1885 he emigrated to Australia and in 1885-86 worked as assayer, then manager, of the Cunnigar GMCo near Cootamundra in southern New South Wales. For three years from 1886 he was a lecturer in mineralogy at Gympie, Maryborough and Bundaberg for the Queensland Department of Mines. In 1889-93 he was manager for the Queensland Minerals Exploration Co Ltd of the Old and New Long Tunnel (gold) Mine at Kilkivan, 50 km west of Gympie. He also held a Kilkivan gold mining lease for two years from 1892. He was a partner in the Bundaberg company, Hooker and Kekewich, mining engineers and assayers, in 1889-93 and was also a Kilkivan Shire councilor for three years from 1890. In September 1893 he was manager of Longwood Sluicing Co in Reefton, New Zealand, and also held a tin claim on Stewarts Island, New Zealand. In 1894 he moved to Western Australia to become manager of the Kalgoorlie mining company, Ivanhoe GMGCo (ECGF Boulder), but resigned in August 1895 after a disagreement with the Melbourne directors over the progress of development work. He then appears to have joined Lake View and Boulder East GMGCo but had left before May 1896 when Whitaker Wright acquired the company from which he formed Lake View Consols Ltd. Hooker also prepared a report on the Prince of Wales mining prospect (CGF Gnarlbine). Hooker moved to Kanowna in 1896 to manage North White Feather Consolidated GMGCo (NECGF Kanowna), formed in March 1895. In 1900 he was in Borneo as mining engineer for Bengkayang GMGCo and in the following year for Kahayan GMGCo. In 1903 he returned to Western Australia to work on the cyaniding of tailings dumps in Southern Cross (YIGF) and, in 1906, was assayer at Kapunda Mines in South Australia. In 1911 he moved to Melbourne where he worked as a computer (statistical calculator) for the Commonwealth Bureau of Census and Statistics until his retirement. He died in South Yarra in 1932, aged 72.

*WArg* 26 Aug 1895, 26 Jan 1899; *WAGFC* 11 Jul 1986 p.28; Skinner 1897, 1899, 1906; Ivanhoe GMG Co ann reps 1894-95; R. Hooker pers. comm. March 2002



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**HOOPER, Edward** MIMM, MICE (1861-1955)

Hooper was born in England at Huntingdon and from 1885 was a pupil of T.J. Bewick, civil engineering and mining consulting engineer, for whom Hooper worked on mining and railway projects in the north of England. In London, in 1886, with another of his former pupils, C.A. Moreing, Bewick formed the company, Bewick, Moreing and Company, mining and civil engineering consultants. In 1890 the company opened a branch office in San Francisco of which Hooper was appointed manager. After the discovery of gold in Coolgardie, Hooper returned to England and was appointed the company's representative for Australia. He travelled via Johannesburg, Melbourne and Perth, to Coolgardie where he arrived in October 1894 and established a branch office. The company's main objective was to locate prospectors' mines which had potential for development by public companies and to acquire them through an agency company. For each prospect recommended Bewick Moreing would float a public company which would purchase and operate the mine. In November 1894 Hooper travelled by camel to inspect mines in the Edjudina and Yerilla area (NCGF) and the Mt Margaret and Mt Morgans region (MMGF). In January he went via Geraldton to inspect prospects in the Murchison Goldfield (including what became the Great Fingall mine at Day Dawn). He established a branch office at Cue but contracted typhoid fever and had to return to Perth to recuperate. In Perth he discovered that his assistant 'had been involved in some dishonesty in the purchase of some mining properties. He was recalled to London and made to reimburse the company'. In May-July 1895 Hooper travelled 560 miles by camel to inspect 13 mining properties in the NCGF and EMGF and from Lawlers went by buggy to inspect four others in the MGF. In 1896 he inspected a further dozen and then sailed from Albany to NSW to inspect the Bethanga mines. In May 1897 Herbert Hoover arrived in Coolgardie to assist in inspecting mining prospects. On 21 June Hoover visited the Sons of Gwalia mine at Leonora and advised Moreing to secure an option on the mine which he did. At the beginning of September Hoover was back at the Sons of Gwalia for a more thorough inspection after which he sent a lengthy cable to London recommending purchase of the mine. On 26 September Hooper inspected the mine and confirmed Hoover's recommendation. On 17 November 1897 Bewick Moreing's exploration company purchased the mine and the Sons of Gwalia Ltd company was formed in London and Hoover later became Bewick Moreing's first manager of the mine. In 1898 Hooper was the Western Australian director of Water Trust Mining and Public Crushing Company of WA which planned to implement a scheme devised by E. Vanzetti (q.v.) to transport gold ore by rail to a processing plant near Northam. He was also the colonial manager of Continental and Western Australian Trust, one of Moreing's speculative investment companies.

After Bewick's death in August 1897, Moreing invited Hooper and Bewick's son, J. Burrell Bewick, to become full partners in Bewick Moreing & Co. Hooper returned to London via New Zealand and British Columbia where he inspected the company's interests and established branch offices at Auckland and Vancouver. In August 1900 he returned to Western Australia for five months to inspect all mining properties owned, managed, worked under option and advised by the company which included properties on the Hampton Plains and near Lake Lefroy (CGF) and the group of mines in the Lawlers district (EMGF) centred on East Murchison United. In September 1901 the three man partnership of Bewick Moreing & Co was dissolved and Moreing formed a new partnership under the same name which included Moreing and Hoover but not Hooper or J.B. Bewick. Some of the interests of companies previously served by Bewick Moreing were transferred to Hooper who joined W. Speak in a partnership, Hooper and Speak (later Hooper, Speak and Williams). In 1904 Great Boulder Perseverance Ltd (ECGF Boulder) appointed Bewick Moreing to be its manager but under stringent conditions. Due to disagreements over the mine's reserves the management agreement lasted less than five months. The following year Hooper was asked to inspect and report on the Boulder Perseverance mine. Subsequently Hooper and

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Speak was appointed consulting engineer to the company and Hooper was made a director. After Hooper had reported on Boulder Perseverance in 1905 he visited the following mines managed by Bewick Moreing, Sons of Gwalia Ltd (MMGF Leonora), Vivien GMg Co Ltd and East Murchison United (both EMGF Lawlers) and Bellevue Ltd (EMGF Sir Samuels). Hooper was a vice-president of the Institution of Mining and Metallurgy between 1906 and 1911, and was president of the Institution in 1912-13. He retired in 1942.

WAGC 25 Jul 1896; Skinner 1897, 1905, 1909, 1915, 1920; TIMM 65, 1955-56; BLPA 2202A; Nash 1

**HOOVER**, Herbert Clark BA, FRGS, MAmIMME (1874-1964)

Hoover was born in 1874 at West Branch, Iowa, the second son of a blacksmith. After both his parents died he went to live in Oregon with his uncle, a school teacher. In 1891 he enrolled in the first year of the new Stanford University in California. After graduating with a degree in geology he worked for two years in mining-related occupations. In 1896, his employer, a Californian mining engineer, recommended him to a London-based firm of mining consultants, Bewick, Moreing and Company (BMC), which was seeking the services of a mining engineer to report on gold mining prospects in Western Australia. Hoover accepted the post offered and arrived in the goldfields in May 1897. His work involved inspecting mining prospects and assessing their potential for development as company-owned mines. Over six months Hoover travelled extensively, reporting on dozens of prospects one of which was the Sons of Gwalia mine near Leonora. Hoover first visited the mine at the end of June 1897 and, after a full inspection in August, recommended that the mine be purchased. In January 1898 a new public company 'Sons of Gwalia Ltd' was registered and BMC became its general manager and engineering consultant. In April 1898 Hoover became the company's first mining superintendent. He managed the mine for seven months, planning all its major elements and establishing a tight cost-cutting industrial regime. In November 1898 BMC appointed Hoover to a new position in China. He travelled there via California where he married Lou Henry, another Stanford graduate, who accompanied him to Tientsin in north-eastern China where Hoover was the technical adviser to the Chinese provincial director-general of mines. During the Boxer rebellion Hoover arranged the purchase of the valuable Kaiping coal mines by an Anglo-Belgian company formed by Moreing.

In September 1901 the Hoovers returned to London where Hoover was made a partner in BMC and became responsible for operating all mines managed by the company which were then principally in Western Australia. In early January 1902 Hoover was back in Perth and during the next three months he inspected all 15 of the mines which BMC managed or worked under option. It was a strenuous summer journey covering 3000 km by train, 400 km by coastal steamer and 1200 km by horse and trap. After his visit most of the mine managers were relocated and the first to arrive of the 20 engineers and foremen whom Hoover recruited from the USA were placed in strategic positions. A common costing system was set up at all the BMC-managed mines so that variations in working costs (the cost of mining, raising and processing ore) at each mine could be compared. This information was used to illustrate the improvements made by BMC and to contrast its publication with the policy of secrecy adopted by other companies. The watershed of BMC's expansion in the state occurred in 1904 when BMC agreed to take over the management of two of the largest gold producers in Kalgoorlie. However, the goals of both agreements were unrealistic and both contracts were terminated within a year.

Hoover returned to Australia for further supervisory visits in 1905 and 1907. In addition to the Western Australian mines he visited Broken Hill where a BMC-managed company, the Zinc Corporation, was developing the innovative flotation process to extract zinc from extensive mine tailings. In 1907 he also explored the ancient Bawdwin mines in north-eastern Burma and subsequently organised modern working of its rich silver-lead-zinc deposits.

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Hoover left Bewick Moreing in June 1908 and became an independent engineer-financier based in London. In the years before the First World War his interests extended to the development of mineral and petroleum resources in Tsarist Russia. When war broke out he organised the Commission for Relief in Belgium which provided humanitarian relief to people whose supplies had been cut off by hostilities. When the USA entered the war he headed President Wilson's Food Administration before organising post-war famine relief in eastern Europe. He returned to the USA in 1919 and served as Secretary of Commerce from 1921 to 1928 under Presidents Harding and Coolidge before becoming President of the United States in 1929. His engineering and mining publications include:

- 'The superficial alteration of Western Australian ore-deposits', *TAmErIME* October 1898;
- 'Mining and milling gold ores in Western Australia', *E&MJ* 17 December 1898, pp.725-26;
- 'Metal mining in the provinces of Chi-Li and Shantung, China', *TIMM* 8, 1900, pp.324-31;
- 'Gold mining in Western Australia in 1902', *E&MJ* 3 January 1903, p.18;
- 'Metallurgical methods at Kalgoorlie, W.A.', *E&MJ* 21 March 1903, p.437;
- 'Gold mine accounts', *E&MJ* 11 July 1903, p.44 (letter to editor);
- 'Ore treatment at Kalgoorlie', *E&MJ* 15 August 1903, p.228;
- 'Future gold production of Western Australia', *TIMM* 13, 1903-04, pp.2-21;
- 'Permanence in depth in Kalgoorlie', *E&MJ* 31 October 1903, p.655;
- 'The economic ratio of treatment capacity to ore-reserves', *E&MJ* 24 March 1904, p.478;
- 'The valuation of gold mines', *E&MJ* 19 May 1904, p.801;
- 'Mine valuation', *E&MJ* 7 July 1904, p.44 (letter to editor);
- 'Ore-reserves', *E&MJ* 18 August 1904, p.253 (letter to editor);
- 'The training of the mining engineer', *Science, N.S., (USA)*, vol. xx, no. 517, 25 November 1904, pp.716-19;
- 'Western Australia: [gold mining in 1904]', *E&MJ* 5 January 1905, pp.41-42;
- 'West Australian gold mining in 1905', *E&MJ* 20 January 1906, p.136 & 17 March 1906, p.520;
- 'Are we near gold output limit?' *The Sun* (San Francisco) 8 September 1912;
- 'Mine valuation and mine finance', *MMg* October 1912, pp.275-77;
- 'Economics of a boom', *MMg* 1912, pp.370-72;
- 'Is gold output near maximum?', *New York Times Annalist* (London), 21 April 1913;
- (with L.H. Hoover) 'Theories of ore deposition prior to the seventeenth century', *M&SP* 5 October 1912, pp.426-30;
- (with L.H. Hoover) 'Notes on development of mining law', *E&MJ* 2 November 1912, pp.823-26;
- Books: *Economics of Mining*, New York, 1906 (joint author);
- Principles of Mining: Valuation, Organization and Administration*, New York, 1909;
- (with L.H. Hoover) *Georgius Agricola, 'De Re Metallica' translated from the first Latin edition of 1556*, New York, 1912;
- The Memoirs of Herbert Hoover; Vol.1 :Years of Adventure 1874-1920* (1951); *Vol. 2: The Cabinet and the Presidency 1920-1933* (1952); *Vol. 3: The Great Depression 1929-1941* (1952)
- WAGC 5 Feb 1898; Skinner 1904, 1909; *Who's Who of America* 1916-17 pp.1200-01; Reid pp.65, 267; *ADB* 5, p.361; Nash 1,2; RH.BMC

**HOWE**, Alexander Maxwell ASASM, MAusIMM, MIMM (1878-1934)

Educated at St Peter's College Adelaide, and the South Australian School of Mines, Howe became the assayer and superintendent of the cyanide works at the Princess Royal GMgCo (DGF) on the Princess Royal Reef 8km north of Norseman in 1901. He joined the battery staff at the Great Boulder Perseverance GMg Co (ECGF Boulder) at Kalgoorlie

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shortly afterwards. He was appointed manager of the state battery at Pigwell (MMGF) near Leonora in 1905, and State Inspector of Batteries in 1906. He succeeded J. Dunstan (q.v.) as Superintendent of State Batteries in 1912, and became also Chief Inspector of Machinery in 1928. In the same year he succeeded A. Montgomery (q.v.) as State Mining Engineer, and on his retirement was succeeded by R.C. Wilson (q.v.) in 1934.

RDM 1912; *ProcAus/IMM* 95 Sept 1934, 97 March 1935; Gibney/Smith 1, p.347

**HUDSON**, James Owen MAusIME (b.1868)

Born in Hokitika in New Zealand, Hudson studied mining at the Reefton School of Mines. He worked in the New Zealand mining industry until 1893 when he moved to Western Australia and joined Bewick Moreing and Co, consultants and mine managers, for whom he worked as an inspecting engineer reporting on mining prospects mainly in the Murchison Goldfield and in 1895 was appointed manager of Kinambra (Wealth of Nations) Ltd. The mine near Kunanalling (CGF) was abandoned in 1896 and a new substitute property at Lawlers (EMGF) was also surrendered. In 1897 Hudson joined the Mines Department's inspectorate and was appointed inspector of both North Coolgardie and Mount Margaret Goldfields. In 1903 he was transferred to Kalgoorlie as inspector of the East Coolgardie Goldfield. He contributed evidence to the Royal Commissions on 'Immigration of non-British labour' (1904), 'Ventilation and sanitation of mines' (1905), 'Pulmonary diseases amongst miners' (1910-11) and 'Miners' lung disease' (1911-12). Hudson was appointed Chief Inspector of Mines in Tasmania in 1914.

Skinner 1900; Battye 2, p.355.; *MER* June 1914

**HUNTLEY**, Erle

Huntley worked in gold mines in the Burnett and other districts of Queensland before coming in c.1895 to Kalgoorlie where he designed and built cyanide plants for mines on the Golden Mile. In 1896 he was closely involved in the first identification of telluride of gold in Kalgoorlie. Despite the claim of A.J. Holroyd (q.v.) to have been the first discoverer, a thorough investigation by the geologist Dr Malcolm MacLaren in 1912 (published in *Mining Magazine* of July 1912) concluded that Huntley had the prior claim although Holroyd had been the first to report the discovery in the press. The manager of Block 45 mine (ECGF) in Kalgoorlie, Richard Eades, took samples from the mine which gave high gold assays but had little free gold. On 24 May 1896, two of his associates showed one of the samples to Huntley who, based on his experience in Queensland, suggested that the sample could be gold telluride. On the following day Huntley confirmed his opinion with a blow-pipe test in A.J. McGeorge's assay laboratory and later that day advised Peter MacIntyre (q.v.), the WA representative of the company holding the cyanide process patents. On 27 May Eades sent further samples to Holroyd for assay. With MacIntyre's help Holroyd proved the existence of telluride of gold and on 29 May advised the press. Holroyd's letter to the *Kalgoorlie Miner* was published on 1 June. Huntley had written an article about the telluride discovery for the *Australian Mining Standard* in May but the article was not published until 18 June 1896. Subsequently Huntley became metallurgist for Ivanhoe Gold Corporation (ECGF Boulder) which by 1899 was mining mainly oxidised ore and also the first of its sulphide ore which contained some very rich sulpho-telluride ore. In 1899 Huntley was engaged in building a small experimental plant for treating the sulpho-telluride ore. The plant was similar in principle to the 'dry crush and roast process' pioneered by Marriner (q.v.) at the Boulder Main Reef mine. The Ivanhoe was the only mine in Kalgoorlie apart from Boulder Main Reef to roast its sulphide ore by means of a vertical shaft furnace. Unlike Boulder Main Reef's roaster, the Ivanhoe's worked satisfactorily although, because of its small size, on the basis of cost per unit, it was expensive to operate. Huntley resigned from Ivanhoe in 1900 shortly after the experimental sulphide plant began operation and was appointed manager of a copper mine and smelter 45 km east of Leonora. In 1899 a number of mineral leases containing copper

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deposits around Murrin Murrin (MMGF Mt Morgans) were consolidated into Anaconda Consolidated Copper Mines which was named after the most southerly of the three main mines. A centralised smelting works were sited at the Anaconda mine but was unsuccessful as the smelter was too small to maintain the necessary production temperature. A new London company Murrin Copper Mines Ltd took over the property of Anaconda Copper in 1902. A new water-jacketed blast furnace smelter was built which, in 1903, produced over 790 tons of contained copper. However for a variety of reasons the plant was shut down by the end of the year and the company was liquidated in 1904. Huntley returned to Queensland and became engaged in the Central Queensland copper industry.

Reid p.268; RH.Kalg, cp 2.2; Chappell pp.195-98; MRB 13 pp.122-25; MMg July 1912.

**HYLTON**, James Ray BSc, MAusIMM (c.1894-1969)

Hylton graduated in 1914 from the University of Adelaide where he studied metallurgy. In 1920 Hylton joined the Burma Corporation, the general manager of Burma Mines Ltd which was mining a large silver-lead deposit at Baldwin in north-eastern Burma. Commencing as mill foreman he became assistant mill superintendent in 1923. In London in 1930 he was the joint founder of a consulting engineering partnership, Hosking and Hylton, before returning to Australia where he became assistant general manager of the Great Boulder Pty GMs (ECGF Boulder) in 1934 and its manager in 1935. He was elected a member of the Australasian Institute of Mining and Metallurgy in 1938, and was a vice-president of the Western Australian Chamber of Mines between 1943 and 1951. He retired from Great Boulder Pty. in 1950, and was a director of Amalgamated Tin (Greenbushes) Pty. in 1955. He was in New South Wales in 1961.

MCER June 1936; CMWA 1943, 1950. ArcAusMM

I

**ILES**, John Maguire MAusIME, MIMM (1865-1934)

Born in Kiandra, New South Wales, Iles moved to Tasmania as a young man and spent twenty-three years in the mining industries of Tasmania, Victoria and New South Wales. In Tasmania he was a pioneer prospector of the Zeehan silver mining district and was the manager of the West Cumberland Tin Mine in 1885. He also managed a number of other mines in the state. He moved to Western Australia in 1894 where he managed the Cue No.1 GM and the Kangaroo GM (both MGF Cue). Between 1896 and 1903 he was at South Kalgurli GMs (ECGF Boulder) which produced 31 thousand ounces of gold in 1902 which was the eighteenth highest annual production of a single mine in the state in that year. Iles was elected a member of the Australasian Institute of Mining Engineers in 1901. He moved to Chile in 1904 where he worked for the Central Chile Mining Company, and in 1910 to Nigeria where he became manager of the Rayfield (Nigeria) Tin Mine. He was in England in 1920.

WArg 1 Oct 1896, 23 Mar 1899, 16 Mar 1900; JCMWA 1902; Clark p.81; Skinner 1899, 1903, 1905, 1915, 1920; TIMM 44, 1934, p.567; RH.Kalg tab 4; Thiel p.330

## J

**JAMES**, Alfred Trewartha FCS, FGS, FSCI, MIMM, MAmerIME, MAusIME (1867-1931)

Alfred James was the son of a mine manager at Redruth, Cornwall, and was educated at Camborne and King's College, London. He began his career in the metallurgical laboratory of Cassel Gold Extracting Co. Ltd, in Glasgow, in 1886, and subsequently became the company's laboratory manager and later its technical manager. The Cassel Co. owned the MacArthur-Forrest cyanide patents for gold extraction and J.S. MacArthur (q.v.), the leader of the process discoverers, was employed by Cassel. James is universally recognised as having been chiefly responsible for the very rapid spread of the cyanide process around the world which revolutionised gold ore processing. Metallurgists and chemists were trained in its use on known refractory ores at the Cassell laboratories and were sent to the main goldfields of the world to build and operate cyanide processing plants. James, himself, led the way by going to the South African Rand goldfields in 1888, where he successfully applied the cyanide process to the treatment of gold tailings, building plants at the Salisbury and Robinson GMg companies, giving fresh impetus to a depressed industry. He was subsequently instrumental in extending the use of the process to New Zealand, Australia, and America. In 1897 James left Cassel to establish an engineering consultancy, initially in partnership with MacArthur and then as sole proprietor in London. During the course of this business he visited all the leading minefields in the world and took an active part in the introduction of fine grinding machinery and other new equipment required for the 'all sliming' process first introduced in Kalgoorlie. In 1901 James published *Cyanide Practice* (London 1901) which became the standard reference book on the subject and which was revised and reissued in numerous additions. James also wrote extensively on new developments in gold ore processing. For nearly ten years he wrote an annual review of new types of processing equipment, such as grinders and vacuum filters, which compared the performance of each. These articles provided an important boost to the development of new equipment. One of claims which James made several times between 1905 and 1907 was that Kalgoorlie was the world leader in developing new types of equipment and in adapting existing ones to suit its special needs. During the First World War James worked on the development of equipment for the anti-submarine campaign. After the war he was interested in the development of explosives for mining and in base metal mining, particularly tin. In 1930 he retired to South Africa but died shortly afterwards. He was elected a member of the Institution of Mining and Metallurgy in 1895, a member of the Council in 1898 and was its President in 1908-09.

His other publications include: 'Cyanide Practice', *TIMM* 3, 1894-95, pp.369-405, 407-16;

'Sump solutions, extractor-box work and cleaning-up, in the Cyanide Process', *TIMM* 6, 1897-98, pp.2-9, 11-13;

'Slimes treatment without filtration or decantation', *TIMM* 7, 1898-99, pp.63-67, 70-72;

'Treatment of Kalgoorlie sulpho-telluride ores', *TIMM* 8, 1899-1900, pp.484-518;

'Metallurgical progress in Western Australia', *E&MJ* 3 Jan 1903, pp.18-19;

'Metallurgical methods at Kalgoorlie, W.A.', *E&MJ* 21 Mar 1903, p.437;

'Metallurgical progress in Western Australia', *E&MJ* 7 Jan 1904, pp.30-31;

'Progress in gold-ore treatment during 1905', *E&MJ* 6 Jan 1906, pp.41-43;

'Crushing and grinding practice at Kalgoorlie', *M&SP* 28 July 1906;

'Progress in gold-ore treatment during 1906', *E&MJ* 5 Jan 1907, pp.17-20;

'Progress in cyanidation during 1906', *M&SP* 5 Jan 1907;

Presidential address (twenty years of changes in gold treatment), *TIMM* 17, 1907-08, pp.370-06;

'Progress in gold-ore treatment during 1907', *E&MJ* 4 Jan 1908, pp.17-18;

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'Progress in the treatment of gold ore', *M&SP* 4 Jan 1908;

'Progress in cyanidation', *M&SP* 2 Jan 1909;

'James' annual cyanide letter', *M&SP* 1 Jan 1910;

'Progress in treatment of gold and silver ores during 1910', *M&SP* 7 Jan 1911;

'Progress in cyanidation of gold and silver ores during 1911', *M&SP* 6 Jan 1912;

'Progress in gold-silver ore treatment during 1912', *M&SP* 4 Jan 1913;

*TIMM* 1931-32, pp.656-57; Safford 1908, p.47; Loughheed pp.16-17; RH.Kalgoorlie ch1.3

**JAMES**, Caradoc ABalSM, AMIMM (d.1914)

James was born in Victoria and graduated in 1893 from the Ballarat School of Mines with certificates in assaying and metallurgy. He moved to Coolgardie in 1895 where he conducted a public assay office on his own account. He was then appointed assayer at a mine in Niagara (NCGF) and then at Chaffers GMgCo (ECGF Boulder) at the south end of the Golden Mile next to the Golden Horseshoe mine. From 1898 to 1901 James was assayer at the Golden Link Consolidated GMs (ECGF Kalgoorlie) at the northern end of the Golden Mile near Brownhill. In 1902 he was appointed metallurgist at the Eclipse Lease, one of the two mines within the Golden Link. In 1911 he left Australia to take up the position of metallurgist at the Abosso gold mine in Gold Coast, West Africa. From 1912 until 1914 he was at the Tarquah Mining and Exploration Co. in Tarqua, West Africa. He died at sea en route to Britain from West Africa.

*MMg* 3 (1910) p.264, 8 (1913) p.97; *TIMM* 23 (1913) p.524

**JAMES**, R.H. ( 'Harry')

In 1897 James was the manager of Menzies Gold Estates Ltd (NCGF Menzies) for which Bewick Moreing & Co. was the mining consultant. The mining company was reconstructed in January 1898 and in November James succeeded Herbert Hoover as Bewick Moreing's superintendent of the Sons of Gwalia Ltd mine near Leonora, when Hoover went to China for Bewick Moreing. Hoover had been in charge of the mine for only seven months and much of the mine's infrastructure and development which he had planned was brought into operation under James. In 1902 James was superintendent of a mine at Cue and, in 1903-04, he was manager of East Fingall GMs Ltd. (MGF) and also of Murchison Associated Gold Mines (MGF) which were both at Day Dawn. In 1905 he gave evidence to the Royal Commission on Ventilation and Sanitation in Mines.

Skinner 1897, 1902, 1904; *JCMWA* 1903, 1904; Nash 1 pp.84-85

**JAMES**, John Henry Cordner See CORDNER-JAMES, John Henry

**JAMES**, William Henry Trewartha See TREWARTHA-JAMES, William Henry

**JENSEN**, E.

Jensen was a metallurgist employed before the 1914-18 War by Bewick Moreing & Co., mining consultants and mine managers. He worked at Oroya Black Range Ltd (EMGF Black Range) at Sandstone from 1909 to 1911. In 1912 he was transferred to Great Fingall Consolidated Ltd (MGF) at Day Dawn where he worked until the mine closed in 1914. After the war, working independently from 1918 to 1920, he was at Edna May GM Co. NL (YIGF), the leading mine at Westonia

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which produced 171 thousand fine oz of gold in eight years from 1913. Amongst Jensen's publications is 'Grinding pan practice at the Great Fingall' *JCMWA* 1912, pp.353-62.

*JCMWA* 1910, 1920; Gibney/Smith 2, p.99

**JOHNSON**, John Henry (b.1864)

Born and educated in Auckland, New Zealand, Johnson moved to Melbourne where he worked as a builder for four years. In 1891 he moved to Zeehan in Tasmania where he worked as a miner and mining machinery erector. Returning to New Zealand, he was machinery foreman at Bunker's Hill GM and obtained his mine manager's certificate. Moving to Western Australia in 1900, he became a partner in a mine at Jubilee in the Kurnalpi district (NEGF) and joined a syndicate which established a public stamp battery at Bulong (ECGF). In 1902, Johnson went into partnership with N.A. Friedman. After failing to establish a scheme to treat residues on the Golden Mile, they moved their plant to Broad Arrow where they treated residues from the district's mines and operated a mill which they acquired at Paddington. In 1906 they bought the Ora Banda Extended GM but abandoned it in favour of the more productive Golden Gimlet leases which they acquired in 1909. Johnson later formed the West Australian Portland Cement Company Ltd, the first cement producing company in the state, and established the works at Rivervale in 1921. However the company had difficulty in finding a suitable source of lime, an important component of cement, and potential customers had little faith in the quality of the company's product. The company went into liquidation and a new company, Swan Portland Cement, took over its assets in 1928.

Battye 2, p.358; Firkins p.69; Colless p.134

**JOICE**, John MAusIMM. (b.1866)

Joice arrived in the Murchison Goldfield in 1897 and was working at Menzies in the North Coolgardie Goldfield in 1903 and at the Sons of Gwalia Ltd (MMGF Mt Malcolm), near Leonora, in 1905. From 1910 until 1913 he was manager of North White Feather GMs Ltd (NECGF Kanowna) for Percy J. Ogle & Co which was the general manager of the mine. In 1914 he was manager of Bullrush Gold Estates (YaGF), formerly known as Royal Standard Leases, at Yuin, after which he spent a short time working at the Nybergs iron ore mine in northern Sweden. He returned to Western Australia in 1916 to again take up the management of Bullrush Gold Estates and, in 1917, was manager of New Boddington GM Syndicate Ltd (NCGF Menzies) at Goongarrie. Joice was at the Transvaal Mine near Southern Cross in 1918 when he was elected a member of the Australasian Institute of Mining Engineers. He moved to the Australian Gold Mining Company at Raub in the Federated Malay States (Malaysia) in 1921, and was at the Freda Tin Mine in 1925. He was at Cannington in 1930.

*WAMBEJ* 12 Jan 1907; Skinner 1909; *JCMWA* 1910, 1913, 1917; *MER* Dec 1916 p.51; ArcAusMM

**JOWETT**, William H. MAusIME

Between 1896 and 1899 Jowett was the manager of two of the rich early mines at Menzies, Menzies 'Crusoe' Gold Claims Ltd (NCGF) and Menzies Gold Reefs Proprietary Ltd (NCGF). The former yielded 20dwt of fine gold per ton of ore over 12 years and the latter 37dwt per ton over five years. Jowett was manager of Hannan's Croesus GMg Co. Ltd (ECGF Kalgoorlie) from 1900 to 1901 when it amalgamated with four other Kalgoorlie mines to form Kalgoorlie Amalgamated Ltd. He was manager of the new company from 1902 until 1904. In 1905-07 he was manager of Jacoletti GMs Ltd (YIGF), a new mine at Marvel Loch, and from 1910 to 1913 he was at North White Feather GMs Ltd (NECGF Kanowna) when that mine was successfully reopened. Jowett was elected a member of the Australasian Institute of Mining Engineers in 1901. He was in Kalgoorlie in 1917 when he retired from the industry.

Skinner 1897, 1900; *JCMWA* 1902, 1907



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### **JUDD**, Henry Alexander

Judd arrived in Western Australia from New York in 1896. He was the manager from 1897 to 1901 of Lake View Extended GM (WA) and Lake View South GM (WA) (both ECGF Boulder) which were two adjoining leases to the south of Lake View Consols. (James Judd was chairman of the former.) In 1898-1900 Henry Judd was also at the Central and West Boulder GMs (ECGF Boulder), which consisted of the two former Central Boulder leases adjoining the Associated leases which were known as Blue Gap (of 6ac, one of the smallest leases on the Golden Mile) and Sandfrid, together with the two former West Boulder leases, known as Boulder Consols. Judd visited London at the end of 1898. He was a member of the Kalgoorlie Roads Board in 1900. In 1901 he was appointed general manager of Robinson GMs (WA) (NCGF Kanowna) and in 1905-07 he was manager of Merton's Reward GMCo (MMGF Mt Malcolm, Mertondale), the first independent manager after Bewick Moreing had relinquished management of the mine.

Skinner 1897, 1899, 1902, 1905; GG 1902, p.368; JCMWA 1902, 1907

### **JUKES**, J.V.

Jukes joined the staff of Associated Northern Blocks (WA) Ltd (ECGF Boulder) at the beginning of 1904 when G.M.Roberts (q.v.) took over management of the mine from W.H. Rodda (q.v.). In 1907 Roberts accepted the management of Associated GMs (WA) Ltd (ECGF Boulder) after the resignation of its temporary manager, P. Ledoux (q.v.), who was also a director of Assoc. GMs. At the same time Roberts retained the management of Associated Northern Blocks. Finding the stress of managing two of the Golden Mile's major gold producers excessive, in September 1911, Roberts resigned from the management of Assoc. Gold Mines. In December 1911 Jukes moved from Assoc. Northern Blocks to Assoc. GMs to strengthen the new management under D.F. McAulay (q.v.). He remained with Assoc. GMs for the rest of his career.

Skinner 1904, 1907, 1911, 1920; RH.Kalg cp 8.2

## K

### **KAUFMAN**, Charles ME (1847-1912)

Having grown up in San Francisco and trained as a mining engineer at Freiberg School of Mines in Germany, Kaufman worked for twenty years in the United States' mining industry. He arrived in Western Australia in 1895 as state manager of the West Australian Exploring and Finance Corporation Ltd formed in September 1894 by the mining promoter and speculator, Whitaker Wright, and also of another of Wright's companies, London and Globe Finance Corporation Ltd, formed in April 1895. Both companies operated financial and promotional businesses. In 1895 Kaufman purchased the Wealth of Nations mine (CGF Kunanalling), 35 miles north-west of Coolgardie, and in July 1895 formed a company, Wealth of Nations Ltd, to operate the mine with Kaufman himself as its consulting engineer. The mine's outcrop and near-surface ore was very rich and the prospectors were reported to have removed 10,000 oz from the reef before the sale was finalised. However the rich ore did not extend to depth and the company was forced into receivership. In 1896 Kaufman arranged the purchase of the Mainland Consols mine at Day Dawn (MGF) from which 19.6 thousand oz. of fine gold were obtained from 5.8 thousand tons of ore between 1897 and 1901. Kaufman also purchased a number of other mining prospects on behalf of WA Exploring and Finance Corp. They included Golden Crown (NEGF Kanowna), Paddington Consolidated (BAGF), Hannan's Golden Group and Hannan's Golden Treasure (both ECGF)

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In May 1896 Wright's London and Globe FCL acquired the Lake View and Boulder East leases (ECGF) and formed Lake View Consols Ltd to operate the mine, one of the most valuable on the Golden Mile. In March 1897 Wright combined his two main agency companies, London and Globe FCL and WA Exploring and Finance Corp, into a new company of the same name as the first, London and Globe FCL. In October 1897 this new company acquired the Melbourne registered company, Ivanhoe GMGCo NL (ECGF) for £960 thousand and a new operating company, Ivanhoe Gold Corporation Ltd, was launched. Kaufman offered the separate management of both Lake View Consols and Ivanhoe Gold Corp to Richard Hamilton (q.v.), manager of Great Boulder Pty, but he declined the positions on account of his commitment to Great Boulder. As managers of these mines Kaufman appointed Henry Callahan (Lake View) and Thomas Hewitson (Ivanhoe) (both q.v.). At the end of 1897 Kaufman resigned from Whitaker Wright's employment and took up an equivalent post with Horatio Bottomley, a rival promoter and speculator who controlled another rich Golden Mile mine, Associated GMs of WA. In January 1899 Kaufman acquired the Golden Horse Shoe GMGCo (ECGF) and formed a new company of which he was a director, Golden Horse-shoe Estates Co. (with the Horse-shoe hyphenated), which took over the Golden Horse Shoe leases which adjoined those of Ivanhoe Gold Corp and Great Boulder Pty. As manager of the mine Kaufmann appointed John Sutherland (q.v.) and as its metallurgist George Klug (q.v.), both of whom were experienced metallurgists. Kaufman had a significant influence on the company's choice of treatment methods for the mine's sulphide ores. The valuable sulpho-telluride ore was to be smelted at the mine and the less valuable sulphides sent to South Fremantle for smelting at the Fremantle smelter. With Kaufman's support Sutherland and Klug built a small smelter for the mine, the first to be built in Kalgoorlie. In 1901 and 1902 the smelter processed some of the most valuable ore ever mined in Kalgoorlie.

The first smelting works at South Fremantle was built by Western Australian Smelting Co Ltd and processed Kalgoorlie gold ore from 1898. In April 1900 it was taken over by Fremantle Smelting Works Ltd, a company formed by Charles Kaufman with the assistance of N.M. Rothschild and Sons. John Sutherland was appointed the company's first manager. The smelter, however, had technical and financial problems and closed down in July 1902. A third smelter company, Fremantle Smelter Ltd, with which Kaufman was also associated, was formed in February 1903 to take over the assets of the previous company. George Klug (q.v.) was appointed its general manager and he designed a new smelter for the South Fremantle site which commenced operation in November 1903.

In 1899 a bear attack on Associated GMs of WA bankrupted Bottomley. Kaufman was also reported to have lost heavily as a result of his association with Bottomley. He became increasingly interested in the mining of copper and lead, the values of both of which were increasing as a result of European rearmament. In 1903 Kaufman visited copper-gold prospects in the Phillips River Goldfield, 330 km south-west of Kalgoorlie, and later took an option on eleven leases in the district and commenced mining in 1906. He also bought a smelter which the Government had built just west of Ravensthorpe (PRGF), the ownership of which he transferred to the Phillips River Gold and Copper Company Ltd, the company which he had formed in January 1906.

In 1902 Kaufman purchased from prospector Fred Merton the Merton Reward mine (MMGF Mertondale), an open cut mine from which Merton had already extracted large quantities of gold. It was then purchased by N.M. Rothschild and Sons which launched Merton's Reward GMCo of which Kaufman was the chairman and consulting engineer. Bewick Moreing and Co was the general manager for a year but an independent manager (H.A. Judd q.v.) became manager in 1905. Kaufman was also a director of Ivanhoe South Extended GMG Estates Co (ECGF Boulder) in 1900-06, of Golden Horse-shoe Estates Co. from 1905 until his death in 1912, and of Phillips River Gold and Copper Company in 1906-09.

*WAGC* 4 May 1895 p.29, 11 July 1896 p.21, 29 Jan 1898 p.25; *WArg* 9 Feb 1899; Skinner 1897, 1899, 1905, 1906, 1909; *WAMBEJ* 30 April 1904; *RH.Kalg* cp 3; *Gibney/Smith* 1, p.384.; *Bridge. J.Dunn* pp.51-54.

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**KENYON**, Walter Bedford MAusIME (b.1871)

Kenyon spent three years working for gold mining companies in London before joining, in 1896, Glenrock Consolidated Ltd, a company with mines in India and New Zealand. In ca. 1900, he moved to Western Australia where before 1903 he worked as a metallurgist at Britannia GM Co. Ltd (NCGF Kookynie). After 1904 he worked at Lancefield GM Co. Ltd (MMGF Laverton), then at the Sons of Gwalia Ltd (MMGF Leonora) and in 1906-07 at Jacoletti GM (YIGF Marvel Loch). He was elected a member of the Australasian Institute of Mining Engineers in 1907, and was at Golden Pole GMs Ltd (NCGF) at Davyhurst in 1909 and in Kalgoorlie in 1914. JCMWA 1905-1907; ArcAusMM

**KINGSTON**, Charles B. BA, BSc, MIMM, MAusIME

Kingston was a mining engineer with the WA Bullion Corporation in 1899 and in 1901 he was at the Kanowna mine of London and Coolgardie Exploration Ltd. (NECGF). With G.M. Browne (q.v.) he formed the partnership, Kingston and Browne, mining consultant and manager. In 1904 the partnership managed Bayley's Consolidated GM Co. at Coolgardie and Kalgoorlie United Gold Consolidated GM (ECGF Kalgoorlie) and in 1905 it managed Mount Ida GM Co. (NCGF Menzies). The extended partnership of Pearce, Kingston & Browne was consulting engineer to the Peak Hill Goldfield Ltd (PHGF) in 1909. In 1915 Kingston was in Rhodesia and was with Anglo-American Corporation in 1929. He was president of the Institution of Mining and Metallurgy (United Kingdom) in 1938-39.

JCMWA 1902; Skinner 1899, 1904, 1905, 1909, 1915

**KLUG**, George Charles ASASM, MIMM, MIMMAmer, MAusIMM. (1875-1935)

Born in Ballarat, where his father managed a mine, Klug was educated at Ballarat Central School and the South Australian School of Mines from which he graduated in 1894 with an associateship in metallurgy. After working for G.A. Goyder, the State Government analyst, for several years he became a chemist with BHP at Broken Hill in 1896 and was appointed its chief chemist, assayer and assistant metallurgist in 1899. In the same year a new Kalgoorlie mining company, Golden Horse-shoe Estates Co. Ltd (ECGF Boulder), was formed by Charles Kaufman (q.v.) to take over the assets of the former company, Golden Horse Shoe GMC. In 1900 Klug was appointed metallurgist for the new company. Ore being worked by the Golden Horse-shoe was still predominantly oxidised but some very rich sulphide ore was being developed in conjunction with less valuable sulphides. The company's policy was to send the less valuable sulphides and concentrates to Fremantle for smelting and to build a small smelter at the mine to process the high grade sulpho-telluride ore. The small smelting works which commenced operation in 1901 was the most advanced processing plant yet built on the Golden Mile. John Sutherland, the mine manager, (q.v.) appears to have been largely responsible for its design and Klug for its commissioning. Its three stages consisted of a water-jacketed blast furnace, two cupellation furnaces as the second stage and a Miller's chlorination plant as the third. In both 1901 and 1902 the smelter processed some extremely valuable ore. In 1901 26,643 oz of bullion were produced, averaging 237 dwt per ton and in the following year 23,299 oz bul. averaged 320 dwt per ton.

The first Fremantle smelting works was built at South Fremantle by the Western Australian Smelting Co Ltd, a company formed by George Brockman, the Kalgoorlie mine promoter. The works were managed by Walter Koehler (q.v.) from the end of 1898 until April 1900 when it was taken over by Fremantle Smelting Works Ltd, a company formed by Charles Kaufman. The new company was managed by Sutherland until early in 1901 when Klug took over its management. Smelting of Kalgoorlie ore was essentially an interim measure until the mines' sulphide plants began to operate effectively but, from 1900, the Fremantle smelter had no shortage of customers. However, the smelting works, the three stages of

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which were similar to those of the smaller smelter at the Golden Horse-shoe, had technical difficulties, in addition to liquidity problems, both of which forced the smelter to close down in July 1902 and the company to go into liquidation.

In 1903 Klug became the director of two mines in the Murchison Goldfield, Anchor Consolidated GMs (WA) at Tuckanarra (MGF Cue) and Windsor Consolidated (WA) GMs at Mt Magnet East. Both were only minor producers. Despite the fate of Kaufman's Fremantle smelter company, another one, Fremantle Smelter Ltd, with which he was also associated, was formed in February 1903 to take over the assets of the previous company. Klug was appointed its general manager and he designed a new smelter for the same site which operated on different principles to the previous one. The smelter had several parallel production lines, each consisting of a reverberatory furnace followed by a Bessemer converter of the copper type and third stage of bullion refining. The smelter was one of the first on the Australian mainland to use this type of converter. It commenced operation in November 1903. In the thirteen months in which no smelting had been done at Fremantle, many of the Kalgoorlie mines had found alternative means of treating their sulpho-telluride ore and the smelter turned increasingly to the smelting of copper and lead.

In March 1904 Bewick Moreing & Co. made an ill-judged management agreement with the directors of the Golden Horse-shoe mine which was conditional upon Bewick Moreing reducing the working costs of the mine by 40 per cent by the end of the year. However, Bewick Moreing had the full cooperation of neither John Sutherland, the manager, nor the London directors. Sutherland left Kalgoorlie for England in April 1904 to confer with the directors. On 17 September 1904 the agreement was abandoned, Sutherland was reinstated and Bewick Moreing was dismissed. As Sutherland did not return immediately, in October 1904 Klug was appointed acting manager of the Golden Horse-shoe. Meanwhile, Bewick Moreing was engaged in the controversial management take-over of four companies controlled by the notorious market manipulator, Frank Gardner, of which the most significant was the Great Boulder Perseverance GMC mine (ECGF Boulder) which, in 1903, was the state's largest gold producer and was the company which paid the highest dividend. As part of the take-over Gardner's manager, Ralph Nichols (q.v.), joined Bewick Moreing but, after a controversial Royal Commission dealing with conflicting estimates of the mine's reserves, by October 1904 Nichols had severed his connections with Bewick Moreing and, in January 1905, left for London to clear his name. Klug who was still acting manager of the Golden Horse-shoe mine was then appointed acting manager of Great Boulder Perseverance. In February 1905 Nichols was reinstated as mine manager by a special meeting of shareholders but at the April 1905 AGM of the company it was announced that Nichols would not be returning to Kalgoorlie and that Klug would be taking his place.

In 1906 Kaufman appointed Klug manager of Phillips River Gold and Copper Co. Ltd, owner of the copper smelter which the Government had originally built (with Klug's advice) just east of Ravensthorpe in the Phillips River Goldfield, 330 km south-west of Kalgoorlie. The company also owned several newly developed copper-gold mines in the district. In 1907 the copper price peaked and the company made its one and only profit. When an English director of the company, visiting the smelter in 1908, disagreed with Klug on company policy, Klug resigned and joined Bewick Moreing. He was appointed superintendent of the Great Fingall Consolidated Ltd mine at Day Dawn (MGF). Although the mine was past its annual peak production of 160 thousand fine ounces, which in 1905 had been the highest in the state, its output in 1908, of 82 thousand ounces, was still the fourth highest in Western Australia.

Klug moved to Melbourne in 1910 to become manager responsible for Bewick Moreing's interests in the eastern states. In 1912 he was appointed general manager of the company's operations throughout Australia, a position which he held for twenty-three years. In those years he oversaw the globally significant development by the Zinc Corporation of the flotation process at Broken Hill and the growth of Bewick Moreing's cooperation with the Collins House group in resource development. He was a director of the Zinc Corporation and of Electrolytic Zinc of Australasia, and also of Gold Mines of Australia Ltd. from 1930. He died suddenly in England while representing the Australasian Institute of Mining and

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Metallurgy at the centenary celebrations of the Geological Survey of Great Britain. He was elected a member of the Institute in 1909. He was its President in 1922 and a member of its Council from 1927. The Institute established the Klug Memorial Award in his memory. He was also a member for some years of the Council of the Institution of Mining and Metallurgy (United Kingdom). In 1906, with A.E. Savage, he registered Commonwealth Patent 5578 for 'improvements to converters' which was renewed in 1913.

His published papers on Western Australian topics include: 'Patching cast iron water jackets' *JCMWA* 6, 1907, p.769; 'Method of stopping flow from a borehole' *JCMWA* 6, 1907, p.20; 'Electro-magnet for removing particles from the eye, used at Great Fingall' *JCMWA* 6, 1907, p.355; 'Slime treatment for the extraction of gold' [Great Fingall] *JCMWA* 9, 1910, pp.169-73; 'Grinding pan practice. Pipe discharge and classification of ground product' *JCMWA* 9, 1910, pp.169-73; and with E.H. Taylor (q.v.) 'The calculation of the relative efficiencies of crushing and grinding machines' [G.B. Perseverance] *JCMWA* Part 1, 4, 1905, pp.944-48; Part 2, 5, 1906, pp.93-97; Part 3, 5, 1906, pp.273-84.

*JCMWA* 1902, 1903, 1905; *WAMBEJ* 18 Apr 1903 p.14, 30 Apr 1904 p.21; Skinner 1904; *John's* p.101; *MER* Nov 1908, p.59; *WWA* 1927-28 pp.141-42, 1935 p.274; 'Obit' *ProcAusIMM* 97, Mar 1935, Liv-Lv; L.Clark pp.3, 228; Gibney/Smith 1, p.401; *ArcAusMM*; Patent Register of W.G. Manners

### KOEHLER, Walter Jaeger

(1860-1901)

Koehler was educated at the Massachusetts Institute of Technology from which he graduated in chemistry in 1881. After working for several years in the American mining industry he moved to Australia where he joined Broken Hill Pty Co. Ltd (BHP) shortly after it had been incorporated in August 1895. In 1896 Koehler was assistant general manager of BHP, under the company's American general manager, William H. Patton. Patton had been recruited by BHP from the Comstock Lode mineral field at Virginia City, Nevada, where he had been manager of the Consolidated Virginia mine. In 1895, the BHP directors decided to expand its lead smelting operations at either, Broken Hill, Newcastle (NSW) or Port Pirie (SA). Port Pirie, on the eastern shore of Spencer Gulf, proved to be the most economical location and the smelters built there became operational in 1897. In the meantime, a South Australian source of ironstone, required for the fluxing of the smelters, had to be located urgently and Koehler was given the task of investigating potential deposits. His report (dated 1895 sic.) recommended that part of the isolated Middleback Range on the western side of Spencer Gulf which was known as the Iron Monarch and contained outcrops of hematite containing over 60 per cent iron. He later reported, prophetically, that it was 'an enormous formation, and can furnish infinitely more iron than the mine would ever need'. In November 1899 the South Australian Government granted BHP the Iron Monarch leases and in 1901 barges took ironstone from the mine at Iron Knob across the Gulf to the smelters. Of even greater significance was that from 1915, when steel was first produced in BHP's Newcastle steelworks, until 1951, when the first iron ore was shipped to steelworks from Yampi Sound in the northern Kimberley, Iron Monarch was the only major source of ore for the Australian steel industry.

By April 1899 Koehler had left Broken Hill and was general manager of Western Australian Smelting Co. Ltd, a company formed by the Kalgoorlie promoter, George Brockman, to smelt copper and lead ores from the Northampton Mineral Field and also rich sulpho-telluride gold ores and concentrates from Kalgoorlie. The company was floated in London in October 1897 and the smelter was built in South Fremantle. It was a three stage process consisting of a water-jacketed blast furnace and cupellation furnaces to produce bullion and a Miller's chlorination plant to remove the silver. The production of sulphide ores in Kalgoorlie took some time to build up and the finances of the smelting company had to be reconstructed in 1898. It was at this stage, at the end of 1898, that Koehler probably became general manager of the smelter as, in early 1899, he travelled to Broken Hill to arrange a contract to purchase lead ore from Broken Hill Block 10 Co. for use in the Fremantle smelter. Weekly smelter production figures were published by him from 17 June to 12 August 1899 after which he is not

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mentioned again by name in the press releases and, presumably, had left the company. Although there were a number of customers for the smelter in Kalgoorlie and the bullion grade remained above average the company was losing money and, in April 1900, was sold to another company, Fremantle Smelting Works Ltd. This company operated the smelter until July 1902 when it went into liquidation.

Walter Koehler took up the management of the Bellevue Mine at Sir Samuel (EMGF Lawlers) in September 1899. Bellevue Proprietary Ltd had been registered in November 1896 to acquire the Bellevue lease, and another in the vicinity, from Forrest Australia Corporation Ltd which was the agency company of Alexander Forrest, the brother of the Premier of Western Australia, Sir John Forrest. Forrest Aus. Corp retained the general management of the mine. In 1899 the company was reconstructed as Bellevue Consolidated Ltd with Forrest Aus Corp remaining general manager. It was at this stage that Koehler became superintendent of the mine and he remained in that position until his death from natural causes at the mine on 25 April 1901. After the organisational break at the mine in 1899, while the company was being reconstructed, gold production began to build up under Koehler to 11 thousand bullion ounces (1901) which rated about the twentieth highest in the state but below the 20 thousand ounces per year usually sought by company-owned mines. After Koehler died the directors of the mining company changed the general manager of the mine to Bewick Moreing & Co. The mine was thought to have a good potential but a series of experienced managers failed to increase production above 20 thousand ounces per year and the mine closed in 1911. No dividends were ever paid.

Koehler's written reports include his report for BHP: 'Notes on Iron deposits near Port Pirie', 25 June 1895 (sic.), BHP Archives S1/10 1896. (Johnston-Liink et al. suggest that the date given on the report (1895) may have been incorrect and that it should probably have been 1896.)

Skinner 1897, 1899, 1901; JCMWA 1902; WAGC 1 Apr, 17 Jun, 12 Aug 1899; *Murch News* 27 Apr 1911; Blainey pp.157, 272; T. Thomas pers com Oct 2001; J.W. Washburn pers com Nov 1999, Feb 2000; Johnston-Liink et al. pp. 154-59, 333

### **KONEMAN, William**

Koneman was an American mineral process designer who had a reputation for original process designs. He first came to the attention of London gold mining investors when the plant which he was building in Florence, Colorado, got into difficulties. W.H. Hartley, who became his business partner, went to Colorado from London and successfully offered terms to induce him to come to London. At the end of 1897 the directors of Great Boulder Pty GMs Ltd (ECGF Boulder), on the advice of Zebina Lane (q.v.), the company's engineering superintendent, and of John Taylor & Sons, its mining consultant, signed a contract with a company formed by Koneman and Hartley, Boulder Milling Company (BMC), for BMC to treat the mine's oxidised tailings and sulphide ore, including its sulpho-telluride ore. BMC was to use a patented treatment process devised by Koneman. The mine manager, Richard Hamilton (q.v.) had not been consulted about the contract and initially misunderstood its terms but after Koneman arrived in Kalgoorlie in May 1898 the two worked together to establish the plant. Hamilton commented 'Koneman may be a "crank" but I certainly think that he is an honest one'. Under the contract Great Boulder would only accept and pay for the plant if it was at least as effective as those of the neighbouring Boulder mines. Koneman's process consisted of six principal stages each of which was non-standard and required development in detail. The stages were a pulveriser, a shaft furnace, a pulp macerating tank, elevating buckets to a large agitating and amalgamating barrel, a pressurised tank to remove the gold solution, and precipitating tiers of a novel type (later replaced by standard zinc precipitation boxes). After trials on a smaller furnace major changes were made to the full scale one which by the end of September was roasting perfectly. Unlike other roasters which required the ore to be finely pre-crushed, ore for Koneman's had only to be crushed to 'hazel nut' size which was a substantial saving. Hamilton predicted that this would lead to 'a revolution in mining'. But, in January 1899, Koneman's process was still not working and 'times were tough'.

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Work was continuing until 12 pm every day as problems in the remaining stages were overcome one after another until only difficulties with the pressure tank remained unresolved. Several trials with the tank failed and its problems proved insurmountable. Hamilton reluctantly recommended to the Great Boulder board that the contract with BMC be rescinded as the process could not be made to work as well as those on other Boulder mines. For the same reason contractual reasons Great Boulder could not use the successful pulveriser or the furnace. Koneman, who had become sick due to stress, returned to London. Had he adopted filter pressing, which some, Boulder mines were already using, instead of his pressure tank Kalgoorlie gold metallurgy might have taken a different turn.

R. Hamilton letter book 2, held by the Hamilton family; RH.Kalg cp.4.2

## L

**LAMBERT**, George James MLA

(1879-1941)

Born at Malmsbury, Victoria, and educated at its State School and Kyneton School of Mines, Lambert moved to Western Australia in 1897. He established an assaying practice in Boulder and operated Lambert's Treatment Company for processing mine tailings. He became a member of Kalgoorlie Municipal Council in 1904 and was the Labor Member for Coolgardie in the Legislative Assembly between 1916 and 1930, and for Yilgarn-Coolgardie between 1933 and 1941. From 1930 to 1933 Lambert was secretary to the Leader of the Opposition, Philip Collier. In the 1930s he formed the General Chemical Supply Company and was a partner of F.W. Teesdale in the Union Plaster Company and in the WA Manganese Company.

RDM 1926; WWA 1938 p.297; Black/Bolton 1 p.113.

**LANE**, Zebina Bartholomew MAusIMM, MLC

(1856-1912)

Lane was born at Moliagul, near Dunolly, in Victoria. He was the eldest son of Zebina Lane Senior, a Canadian-born mine manager. Lane Junior was educated in Bendigo and in 1871 was apprenticed as a mechanical fitter to the Central Foundry in Melbourne. He married at Bendigo in 1878. Although details of his post-apprenticeship employment in Victoria are conflicting, he probably worked at the International Smelting and Refining Company at Spotswood in Melbourne and also spent about eight months working in New Zealand. In 1885 he moved to Broken Hill where he was probably associated with the Broken Hill smelter for a short time, after which he managed the Junction North mine. In 1887 he was appointed manager of Consolidated North Broken Hill and in 1888 he was manager of the Block 14 mine. He was secretary of the Barrier Amalgamated Mining Managers' Association from 1887 and was appointed its chairman in 1892. He was a founder member of the Australasian Institute of Mining Engineers and was one of its councillors in 1893. He was elected to the first Broken Hill municipal council in 1888 and became its second mayor in 1889-90. Broken Hill mine workers started to become more militant from 1890. In 1892 the price of silver fell dramatically and the directors of several companies, including those of Block 14 and Broken Hill Pty Co., decided, in order to reduce costs, to introduce contract mining, a move which was opposed by all local unionists. The directors of the mines concerned then closed the mines and employed strike breakers which led to the collapse of the strike after 18 weeks. Lane, as a prominent senior manager, took the brunt of much of the miners' animosity. They burnt his effigy in the main street and read his mock burial service. Lane and his wife left Broken Hill after the strike.

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Lane moved to Western Australia in 1893 when Coolgardie was booming but was soon to be surpassed by Kalgoorlie. He took a particular interest in the mining leases at the southern end of what was to become the Golden Mile. A number of these leases had been pegged by William Brookman and Sam Pearce for the Adelaide-based Coolgardie GMg & Prospecting Co.(CGMg), headed by George Brookman. In 1894 Lane travelled to London where, in June, he helped G.P. Doolette, of CGMg, launch Great Boulder Pty GMs Ltd (GBP) which became the syndicate's most successful mine. Later Lane claimed that the syndicate did not fully reimburse him for his services although he was appointed GBP's local superintending engineer and attorney. After the launch of Great Boulder Lane travelled to Paris and Berlin to raise further capital for the company. On his return to Australia he arranged for Richard Hamilton (q.v.), an experienced mine manager who had also grown up in Bendigo, to become general manager of GBP from January 1896. Great Boulder had already shown early indications of becoming a rich mine. In its first eight months of operation in 1895 it had produced 26,663 ounces of bullion gold from 4,291 tons of ore with a yield of 6 oz 4 dwt of gold per ton. In Britain Lane investigated possible means of treating GBP's sulpho-telluride ore. At the end of 1897 at his and GBP's mining consultants, John Taylor & Sons' recommendation the GBP board signed a contract with Boulder Milling Company (BMC), a company formed by an American, C. Koneman (q.v.), to treat Great Boulder's oxidised tailings and sulphide ore using a patented process devised by Koneman. Hamilton had not been consulted about the contract and initially misunderstood its terms but when Koneman arrived in Kalgoorlie, in May 1898, he and Hamilton were able to work together cooperatively. The operation of the first two stages of Koneman's process, the pulveriser and the furnace, proved encouraging and difficulties in all the remaining stages except one were eventually overcome. Problems in the final stage, the pressure tank, however, proved insurmountable. Hamilton advised the directors that the process was ineffective and the plant was abandoned. The failure of the process delayed the development of the sulphide plant by eight months and as a result Lane and John Taylor & Son lost their positions with GBP.

During Lane's first visit to London, in October 1894, he formed an investment group, the British Westralian Syndicate Ltd of which he was the superintending engineer. The most prominent member of the syndicate was Frank L. Gardner, an American financier and speculator. The group acquired a number of strategically positioned leases near those of Great Boulder Pty, the most significant being Great Boulder Perseverance, Great Boulder South and Boulder Bonanza. The following year Lane launched companies to purchase the leases and open mines on them. To provide services to these and other developing mines, in June 1896, Lane took over an existing business which he registered as Hannan's Public Crushing, Condensing, and Saw Mills Co. Ltd and became its managing director. Other companies which he helped float included Associated GMs of WA (ECGF Boulder) and the Empress of Coolgardie GMg Co (CGM). He was also interested in the development of the Collie coalfield to provide fuel for the mines and railways. In 1899 he joined in floating Collie Proprietary Coalfields of WA Ltd and was a director of the company from 1904 to 1908. He tried unsuccessfully to briquette its product in 1902. After his first promotional visit to Europe following the launch of Great Boulder he made at least five others (in 1895, 1897, 1899, 1901 and 1904) as Great Boulder's profitable success had made his name as a promoter. In the 1900s he travelled widely to inspect mining prospects in Europe, the United States, China, Japan and Russia.

In 1898 Gardner gained control of Great Boulder Perseverance although Lane remained its Australian resident director. Gardner appointed an experienced American mining engineer, Ralph Nichols (q.v.), manager of the mine and also of the others he controlled in Kalgoorlie, including Boulder Deep Levels (formerly Great Boulder South). Nichols also acted as Gardner's consulting engineer and was often absent from Kalgoorlie on mine inspections. During one of his absences in April 1903 high grades of gold were recorded in a lode in Boulder Deep Levels. Despite Gardner's instructions to the acting manager not to announce the find, the company's shares rose. On Nichols' return more careful sampling found that for several months the samples had been systematically 'salted'. A subsequent Royal Commission was unable to determine



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the *modus operandi* of the fraud. In his evidence Lane said that though he was the local director he had no control over the operation of the mine. At the end of 1903 Herbert Hoover (q.v.), the operational partner in Bewick Moreing & Co., the British mine consultants and managers, had discussions with Nichols about Bewick Moreing taking over the management of Great Boulder Perseverance and Nichols becoming a Bewick Moreing employee. The mine had the second highest gold output in the state, producing 169 thousand fine ounces in 1903, but was widely suspected of having its output forced by the mining of high grade ore at the expense of new development, a situation masked by Gardner's policy of secrecy. When Bewick Moreing discussed a possible management change with the directors in London it was advised that it would be conditional upon Bewick Moreing purchasing 38,500 Boulder Perseverance shares (worth £53,000) from Gardner who was in financial difficulties. Surprisingly, Bewick Moreing accepted the condition, despite its role as the mine's independent manager being seriously compromised. After the agreement had been made, Prichard (q.v.), Bewick Moreing's manager in Kalgoorlie, was asked to check the value of the mine's reserves. He made a rapid sampling of the mine and estimated that the value of the reserves was 30% less than the value previously estimated by Nichols. When Prichard's findings were received by the directors on 18 May there was a marked fall in the value of the shares indicating that the directors had acted on this inside information. Consequently, Bewick Moreing also sold, at a loss, the shares which it had bought from Gardner. While Prichard returned to London, Loring (q.v.), Bewick Moreing's other manager in WA, was asked to do a more thorough sampling of the mine. He found the value of the reserves to be similar to Prichard's estimate but the tonnage of reserves to be 60% lower. Because of the variations in the reserves estimates and the drop in share prices Bewick Moreing's opponents in WA persuaded the Government to form another Royal Commission into the events at Boulder Perseverance. The Commission's evidence indicated that Lane was the only director in Perseverance's London office when the information in Prichard's telegram was received which made him suspect in popular opinion. However other evidence showed that he had not sold his shares until November. Nevertheless his reputation was affected by the adverse publicity and he resigned as a director of Great Boulder Perseverance.

From the late 1890s to 1904 his company, Zebina Lane & Co., developed suburban land in northern East Perth and built houses for rent and sale. In 1903 he built his home in Hay Street, Perth. In 1901 he assisted J. MacCallum Smith in the purchase of the *Sunday Times*. He was a Liberal Member of the Legislative Council for the Metropolitan-Suburban Province from September 1903 until May 1908. He left Western Australia in 1910 to retire to Victoria where he had purchased rural properties for his two sons. He died in Berlin on 20 October 1912 while undergoing medical treatment. He was cremated and his ashes were returned to Victoria where they were interred at St. Kilda cemetery.

Skinner 1897, 1900, 1904, 1909; 'RRC GB Perseverance Mg Co.' V&P WA 1905, 3; 'RRC Boulder Deep Levels Ltd' V&P WA 1904, A13; RH.BMC.thes. ch.3; *MER* Nov 1912, p.57; Stannage pp.215-16; Black/Bolton 1 p.117; Thiel p.331; *ADB* 9, p.659. Stedman pp.30, 203; Birrell 4; Sprake p.45; ArcAusMM

### **LAURI, George Merrilees** AWMC, MAusIMM, AACI (1884-1949)

Born in Boston, Massachusetts, Lauri came to Australia with his father in c.1892. He studied mining and metallurgy at the Working Men's College in Melbourne from which he graduated in 1905 with the Cassilis GMg Company's scholarship. After working for this company for two years, he moved to Broken Hill in 1907 and to Kalgoorlie in 1908 where he worked in the assay office of the Great Boulder Perseverance GMgCo (ECGF Boulder). He became assistant surveyor and assistant underground manager of this mine in 1911, chief chemist and assayer in 1913, metallurgist and mill superintendent in 1918, metallurgist in-charge of the roasting and custom plant under E. Williams (q.v.) in 1924, and metallurgist in-charge of the Boulder Perseverance bromo-cyanide plant under C.E. Blackett (q.v.) in 1932. He retained this position when Kalgurli Ore Treatment Company Ltd. was formed in 1933, and succeeded A.F.B. Norwood (q.v.) as manager of Boulder

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Perseverance in 1939. His published papers include a joint one with G.A. Walker 'Roasting and cyanidisation of arsenopyrite concentrates' *MCER* 32, 1939, p.122.

*MCER* May 1939, p.322; *MYBA* 1940, 1951; G. Lauri, pers. comm. 1991; *ArcAusMM*.

### **LAVATER**, Percy G.D. MIMS

Lavater was the inaugural town clerk of Leonora after the town obtained municipal status in 1900. He resigned in 1901 to take up a position with East Murchison United Ltd (EMGF) at Lawlers under the management of Bewick Moreing & Co. In August 1903 he was appointed mining surveyor at the Sons of Gwalia Ltd (MMGF) at Gwalia near Leonora where he worked until 1909. During this period gold production stabilised between 55 and 65 thousand fine oz which was the fifth or sixth highest annual production in the state. In 1909 Lavater managed Hannan's Pty Ltd (ECGF Kalgoorlie) which held a number of leases in Kalgoorlie for preparation as independent mines. From 1910-13 he was at Oroya Black Range Ltd (EMGF) at Sandstone. This mine, which produced over 25 thousand fine oz of gold each year from 1908, was acquired by Yuanmi GMs Ltd (EMGF Youanmi) in 1911 and was closed in 1913 after which Lavater moved to Yuanmi GMs. In 1916 Yuanmi GMs dispensed with Bewick Moreing as manager of its mine and Lavater was transferred to the Sons of Gwalia (MMGF Leonora) where he was surveyor and assistant manager until after 1920.

*JCMWA* 1909-1920; Turnbull p.33; L. Layman, 'Leonora and Gwalia' in Layman & Fitzgerald (eds), *110° in the waterbag*, Perth, 2012

### **LEDoux**, Pierre

Ledoux was a Belgian mining engineer who was a consultant to the Belgian company, Compagnie Belge de Mines D'Or Australiennes, which had significant investments in Associated GMs (WA) Ltd and in Associated Northern Blocks (WA) Ltd. Ledoux represented the Compagnie Belge as a director on the boards of the two Associated companies in 1904-05 and in 1904 went to Kalgoorlie to inspect the mines. Previously Horatio Bottomley, the speculator and share manipulator who controlled the two companies in the late 1890s, was bankrupted by a bear run on Associated GMs' shares in 1899 and another entrepreneur Herman Landau took control of the companies. He dismissed Associated's manager and appointed a reliable manager, Thomas Hewitson (q.v.), who took control of the mine and made a number of necessary improvements. He retired in 1902, however, and his deputy, Gleisberg (q.v.) was made manager. He was not as experienced as Hewitson and hesitated to make further major changes. When Ledoux arrived in 1904 he dismissed Gleisberg and assumed the management himself. He was manager for two years which provided a much needed period of stability. He replaced the American Ropp long hearth roasting furnaces, whose faulty operation had been the main source of difficulty in processing the sulpho-telluride ore, with the Victorian Merton furnace, a more compact triple hearth roaster which provided better control over the roasting process. Production was stabilised at 55 thousand fine ounces which was maintained until wartime in 1915. Ledoux who represented Belgian investors who had held a large group of shares in Great Boulder Perseverance GMg Co gave evidence to the Royal Commission into the Great Perseverance in November 1904. He advised that a search that he had made into the Perseverance share register in London had clearly demonstrated that there had been insider trading by at least two directors of the company who had made large sales of Perseverance shares through nominees on early receipt of information about a large decrease in the value of the mine's reserves. This was the only clear evidence of trading misconduct which the two 1904 Royal Commissions into share trading malpractice were able to obtain because of the limited information provided by the London authorities. After Ledoux returned to Europe George Roberts (q.v.), probably the most experienced metallurgist in Kalgoorlie apart

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from Hamilton (q.v.), was appointed manager of Associated, a responsibility which he took on in addition to the management of Associated Northern Blocks which he already held.

JCMWA 1905, 1907; Skinner 1904, 1905, 1909; RH. Kalg. ch. 4.4; RH. Bewick Moreing ch 3

### LEE, George L.

Lee took over the management of Gwalia Consolidated Ltd (EMGF) at Wiluna after its manager Alexander Castle (q.v.) died suddenly in December 1905. It was only an interim arrangement until George Hall, Castle's area manager could take over the management and appoint a new permanent manager. In 1908 Lee joined Bewick Moreing & Co., mine consultants and managers, and was employed at the Vivien GMg Co. (EMGF) mine, ten miles north of Lawlers, under manager J. Grigg (q.v.). The following year, Lee was transferred to Lake View Consols Ltd (ECGF Boulder) under O.B. Ward (q.v.). He took part in the amalgamation in 1910 of Lake View Consols with Hannan's Star Consolidated Ltd to form Lake View and Star Ltd. He worked at the mine until after 1920, under H.E. Vail (q.v.), at the start of the major restructuring of the mine which took place in the late 1920s and early 1930s.

JCMWA 1905-20

### LIDGEY, Ernest MIMM, MAmerIME, MAusIME (b.1863)

Lidgely was assistant Government Geologist in Victoria for nine years and spent eighteen months in London representing the Victorian Mines Department in a Mining Information Bureau. He was a foundation member of the Australasian Institute of Mining Engineers in 1893, and was its president in 1901. When he was president he had been consulting engineer since 1899 for the Brunswick Syndicate Ltd which worked goldmines in Gippsland, Victoria. He had also been consultant since March 1900 for the Hampton Plains Estate Ltd which owned 19 blocks of land totaling 216,000 acres and held surrounding leasehold land of 1,216,000 acres in the WA Eastern Goldfields. The blocks were to the south and east of Coolgardie, Kalgoorlie and Kanowna (parts of each of CGF, ECGF and NECGF). The land titles were old ones which included the rights to minerals. Lidgely's Presidential address to the AusIME which dealt with the mining of gold on the Hampton Plains was given at a time of optimism about mining in that area, particularly on Blocks 48 and 50 (ECGF Feysville) where four mines were operating and a centrally located processing plant, as proposed by Lidgely, was under construction. The King battery, as it was called, was operating by March 1902 but the crushing returns were inadequate and Lidgely resigned in September and left for London the following month. He spent several years in London and acquired the Australian patent rights to an electrical method for locating ore. He returned to the Hampton Plains in 1903 for trials of his electrical system but these were unsuccessful. In April 1904 he was managing a cyanide plant in Coolgardie and was practicing as a mining engineer in Boulder in 1905. His published papers include: 'The deep alluvial leads of Victoria, Australia' *TIMM* 7, 1899, pp.96-121; and 'President's address: mining on private property in the goldfields of Western Australia' *TAusIME* viii, 1902, pp.1-30.

Skinner 1900; JCMWA 1902; *WAMBEJ* 4 Jul 1903 p.6, 2 Jan 1904 p.4; *NZ Mines Record* 17 Aug 1903 p.13; Reid p.278. *ArcAusMM*; *KM* 17 June 1903, 14 April 1904; McKay, D., 'The early history of the Hampton Plains Estate Ltd', *JHSWA* Vol 6, Part 7, pp.31-41; Thiel pp.261-65; MacGill pp.15-16, 25-26

### LILBURNE, Albert Shillinglaw MAusIMM (b.1871)

A graduate of the Ballarat School of Mines with a certificate in metallurgy, Lilburne worked as chemist and assayer for the English and Australian Copper (and Silver Smelting) Company, and then for Broken Hill Junction Smelter at Port Adelaide. In 1899 he moved to Western Australia where he built several Edwards roasting furnaces in Kalgoorlie, and, under John Sutherland (q.v.), manager of Golden Horse-shoe Estates Co. Ltd (ECGF Boulder), he was manager of the Fremantle

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Smelting Works when it commenced operation in August 1900. He was metallurgist and mill manager at Mainland Consols Ltd at Mainland beside Lake Austin on the Murchison Goldfield, after which he was metallurgist at Great Boulder Pty GMs Ltd (ECGF Boulder). In 1910 he was at North White Feather GMs Ltd (NECGF Kanowna) and then returned to Victoria where he was at the German Reefs Mine at Maldon in 1911. After working at Cassilis GM and at Maude Reef GM in 1915, he was manager of the Occidental Mine at Cobar in 1916. Returning to Western Australia he was manager of Mary Mac GMg Co. NL at Laverton in 1919. In the eight years from 1913 in which the reformed company operated it produced 8.6 thousand fine oz of gold. Lilburne was employed by Raub Australian GMg Co. in 1930, and was in Queensland in 1934. He was elected a member of the Australasian Institute of Mining Engineers in 1911. His published papers include 'The milling of gold ores' *MCER* Nov 1916, pp.33-34.

*MCER* July 1915 p.231, Dec 1916 p.51; *JCMWA* 1919; Reid p.257; *ArcAusMM*

**LORING**, Edward Amos MIMM (1890-1954)

The son of W.J. Loring (below), Edward Loring was born at Angel's Camp in California and came to Australia with his parents in 1902. He studied mining engineering at Sydney University for two years before joining Bewick Moreing and Sons in 1909 at the Sons of Gwalia Ltd (MMGF Leonora). In 1910 he spent eight months at Broken Hill working at the Zinc Corporation Ltd on the flotation of zinc tailings and at Broken Hill South Blocks on the concentration of lead-zinc ore. After returning to Sydney University to complete his course, he joined the London head office of Bewick Moreing and Company in 1912. In the following two years he assisted the office engineer and accompanied reporting engineers on examinations in Britain, Spain, France and Siberia. From Dec.1913 to Aug. 1915 he was in Cornwall, first as superintendent of Phoenix (Cornwall) Ltd and then as underground manager at East Pool and Agar Ltd. In September 1915 Loring was appointed head of Bewick Moreing's mining engineering department and in 1916 was made a partner in the company. He also directed several of the company's mining consultancies including that of the Sons of Gwalia Ltd. He travelled to Australia in 1915 to inspect the Sons of Gwalia and to report on new machinery requirements. He advised that steam power be replaced by wood (producer) gas power, that the mill be re-built as an all-sliming plant and that the installation of a new winding engine be expedited. In 1919 he was appointed a director of the Sons of Gwalia and was a director of Cue Consolidated Ltd (MGF Cue) in 1920. Following a number of shaft derailments and engine breakages, Loring went to the Sons of Gwalia in 1937 to advise on methods of deeper working. He recommended that to avoid installing a new vertical shaft from the surface an internal one be sunk from the lowest level (level 30) with an electric winder. He also recommended the use of larger skips on the incline to maintain capacity using lower haulage speeds and also that stopes be filled using material cut from surface pits. Loring resigned as a director after the company transferred to an Australian domicile. He was elected an associate member of the Institution of Mining and Metallurgy in 1917, and became a full member in 1921. He was a member of the Institution's council between 1942 and 1953 and was vice-president in the years from 1945 to 1948. His published papers includes: 'Contract system' *MMg* January 1912, p.49.

Skinner 1920; *MYBA* 1940, 1951; Sons of Gwalia Ltd Directors' Reports (Battye) 1919, 1936, 1955; Sons of Gwalia General Manager's Reports (Battye) 1913, 1929; *TIMM & Bulletin* vol.64, 1954-55, p.83

**LORING**, William Joseph MAusIMM, MIMM, MIMMAmer (1869-1952)

William Loring was born in San Mateo county, California, and was educated in San Mateo and Amador counties. He started work, aged 14, at the Empire mill at Plymouth in Amador county where he worked until 1888 when he moved to the Tryon mill in Calveras county. Later in 1888 the mill was bought by Utica Mining Co. and he was transferred to the Utica mill. In 1894 he became Utica mill superintendent in charge of 160 stamps and later mine assistant superintendent. In August

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1901 he became superintendent of the Melones mine at Robinson's Ferry where he erected a water-powered mill with 60 stamps. In January 1902 he was contacted by T.J. Hoover on behalf of his brother H.C. Hoover (q.v.) offering him a position with Bewick Moreing & Co as superintendent of a mine in Western Australia which, after negotiation, he accepted. He left San Francisco on 9 February 1902 and in Kalgoorlie met H.C. Hoover and W.A. Prichard (q.v.), whom he had known in Amador and who had recommended him. He was manager of the Sons of Gwalia Ltd (MMGF Leonora) for two years from 11 April 1902. During the first year he reduced the mine's working cost (excluding development) from 35s 6d per ton to 21s. He tried to reduce wages but an Arbitration hearing raised the award rate instead. In January 1903, after W.R. Feldtmann (q.v.) resigned as Bewick Moreing WA general manager, Loring and Prichard were appointed joint general managers with Prichard responsible for the mines managed in Kalgoorlie and Loring for those in the remainder of the state. Loring travelled 30,000 miles per year by train, ship and horse and buggy to visit the mines for which he was responsible (numbering 12 in 1904 plus others under option). In 1904 Bewick Moreing negotiated a management contract with the London board of Great Boulder Perseverance Pty (ECGF Boulder). When Prichard was asked to check the value of the mine's reserves he found from a rapid sampling that from the manager's previous estimate there was a 30% reduction in the value of the reserves. Prichard returned to London while Loring was asked to do a more thorough sampling. He found the value of reserves to be similar to Prichard's but the tonnage of reserves to have fallen by 60%. In a subsequent Royal Commission Prichard was blamed unduly and resigned on his return to WA. Loring then became the sole general manager for Western Australia and was a vice-president of the WA Chamber of Mines between 1905 and 1908. In 1906 he was appointed Bewick Moreing's general manager for Australia and New Zealand and moved to Melbourne.

Bewick Moreing's activities in the Australian eastern states were experiencing difficulties in the late 1900s. The Victorian deep leads project (1904-08) involving a huge pumping operation to drain underground rivers failed to produce the gold that had been expected. Loring persuaded the Victorian government to assist in the project. Bewick Moreing's attempt to revive the NSW and Queensland copper industry also failed to develop. At Broken Hill, the search, between 1905 and 1908, for the most effective flotation process to separate zinc from the mine tailings went from one crisis to the next until the Elmore Vacuum process eventually proved successful only to be improved upon by one developed by Minerals Separation Ltd. Loring had the uncomfortable position of being the man in the middle between the company directors and the mine's operators. He had a difficult relationship with F.A. Govett, the London stockbroker who was the joint managing director of the Zinc Corp. and who wanted direct control over mines which he had financed. Loring was given no power to make strategic decisions and yet Govett held him responsible for all management decisions. In 1908 Hoover left Bewick Moreing to work on his own account as a mining financier and Loring purchased his partnership in Bewick Moreing and moved to London. Bewick Moreing was manager for Burma Mines Ltd at its large silver-lead mine at Bawdin in north-eastern Burma which Loring visited annually from 1908. In 1910 development work on the mine was still in progress and the smelter was being moved from Mandalay closer to the mine. In 1910 also, he was the first engineer to visit the Porcupine goldfield in northern Ontario where the Hollinger mine was developed. Bewick Moreing formed Northern Ontario Exploration Co. which later was involved in the sale of Hollinger shares in London. In 1909 Loring was a director of the Zinc Corporation, Australian Smelting Corporation, Broken Hill South Blocks, Berry United Deep Leads and Great Fitzroy Mines.

In 1911 Loring went to California for Bewick Moreing to inspect the Plymouth Consolidated mine in Amador County. From his knowledge of other mines on the Mother Lode he correctly anticipated finding 'better ground by deeper sinking' and persuaded Moreing to take up an option on the mine. By 1920 the mine had made over a \$1 million in profit. In 1914 he was on a business trip to Japan, Korea and China when war erupted. Rather than return to London across Europe he went to California intending to investigate further mining properties on the Mother Lode starting with those at Carson Hill in Calaveras County. His Bewick Moreing partners agreed to his staying temporarily in the USA.. British funds had been cut

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off by the war but he obtained finance through a Boston syndicate and Californian banks. His plan was to consolidate the major mines of the district under one management and to modernise their mining and milling operations. By 1919 he had achieved this objective. Before the end of the war Loring's formal ties with Bewick Moreing appear to have ended. After the war he achieved professional recognition by serving for two terms as President of the American Mining Congress. It was the peak of his career. He was managing director of Plymouth Consolidated Gold Mine in 1915, and of California Exploration Company in 1920. He was president of the Carson Hill Gold Mine 1916-24.

During the 1920s and 1930s he suffered several major setbacks from which he never recovered. The first came at Carson Hill where costly development work axed dividends. When his Boston backers made impossible demands, he resigned. He was a bad investor and anticipator of resource cycles. A tungsten mill in which he had invested heavily closed down when demand for tungsten dropped and when copper prices collapsed the value of a copper mine he had developed did likewise. In 1933 he was general manager and part-owner of Arizona Comstock Co. which mined low grade Comstock ore and processed it by flotation. However, the results were unsuccessful financially and share manipulation was suspected. The company shut down in 1938. Loring lost both his money and his reputation. He returned to California and for nearly 15 years worked hard to rebuild his business with little success. He died in 1952, aged 83, in Tonopah, Nevada. He was elected a member of the Institution of Mining and Metallurgy in 1904, and of the Australasian Institute of Mining Engineers in 1909

His published papers include: 'Managing labour in Australia', *WAMBEJ* 15 June 1907, pp.16-17; 'Power on mines', *MMg* Oct 1913, pp.278-79; 'Sampling low grade ore bodies', *M&SP* 9 Jul 1917; 'Re-opening of the Plymouth Mine and results', *M&SP* 27 Nov 1920, pp.771-72; 'The McFadden Bill', *Mining & Science Review*, 19 Feb 1921.

R.H. Limbaugh, 'Making the most of experience', *MHA 1994 Annual*, pp.9-13; R.H. Limbaugh, '“There is a game against us”: W.J. Loring in Bewick Moreing', *JAusMH* vol.2, Sept 2004, pp.90-114; T.A. Rickard, *Interviews with Mining Engineers*, New York, 1922, pp.275-92; *WArg* 11 Nov 1902; *JCMWA* 1903, 1905, 1920; Skinner 1904, 1909, 1915, 1920; Nash pp.230-32, 243, 285 et al.; Johns 1906, p.108

### LOVELL, Gerald

Lovell was a mining engineer employed by Bewick Moreing & Co., engineering consultant and mine manager, as superintendent of mines which the company managed in the East Murchison and Murchison Goldfields during the 1900s. In 1902 he managed Donegal GM (EMGF), a mine south of Lawlers from which Bewick Moreing had built a steam tramway four miles long to a central battery at East Murchison United Ltd (EMGF) at Lawlers. When the tramway locomotive arrived at Lawlers in 1901, hauled by camel wagon from the railhead at Cue, it was claimed to be the first steam locomotive in the north-eastern goldfields. The tramway was later extended ten miles further north to two other groups of mines. In 1903 Lovell was manager of Vivien GMG Co. (EMGF), a new mine which he opened ten miles north of Lawlers. The following year he was manager of East Murchison United when it produced 22 thousand fine oz of gold which was the fifth highest total in that year for a mine outside Kalgoorlie. In 1905-07 he was manager of Great Fingall Consolidated (MGF) at Day Dawn which was the highest gold producer outside Kalgoorlie. The mine reached its peak production of 160 thousand fine oz in 1905 when its total was the equal highest in the state.

*JCMWA* 1902-07; Palmer.Ag pp.7-11; RH Kalg tb4

### LOVELY, William Harvey Chapman MAusIME, MNEIMME (1872-c.1956)

Lovely worked in the mining industries of South Australia and New South Wales and in Singapore, and managed the McKinley and Mount Wells mines in the Northern Territory. He arrived in Western Australia in 1894, and in 1895 established an assay office in Coolgardie with R. Wells as his partner. In 1897 he was consulting engineer and manager of Bunyip

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GMs Ltd. at Cashmans in the Broad Arrow Goldfield. He subsequently moved to South Africa where he established a treatment works in the Transvaal. He returned to Australia in the 1930s and worked at Hillgrove in New South Wales and at Gympie in Queensland.

WAGC 15 Sept 1894 p.4, 16 Mar 1895 p.15; Skinner 1897, 1899; *CIMR* May 1956, p.254

**LYNCH** James Francis ABalSM, MAusIMM, FAIS (b.1876)

Lynch was born in Victoria at Ballarat and was educated at the Christian Brothers College. He graduated from the Ballarat School of Mines with certificates as a mine manager, surveyor and metallurgist. In 1903 he joined F.B. Allen (q.v.) at the newly opened Western Australian School of Mines at Coolgardie as lecturer in surveying. When the School closed and the School of Mines moved to new premises in Kalgoorlie, Lynch became engineer for the Municipality of Menzies until he was appointed superintendent of Boulder Technical School in 1907. In 1913 he joined the staff of Perth Technical School. In 1918 he became supervisor of evening classes at the School and in 1926 Superintendent of Perth Technical College (as it was later renamed). An investigation of Western Australia's system of technical education made by James Nangle, the Superintendent of Technical Education in New South Wales, in 1927 recommended that the WA School of Mines become the responsibility of the Minister for Education rather than the Minister for Mines. This suggestion was most unpopular on the goldfields but when Allen retired as Director of the School of Mines (under the Minister for Mines) and of Technical Education (under the Minister for Education), Lynch was appointed to both positions, both of which were to be under the Minister for Education. Allen's nominated successor, Thomas Butement (q.v.), was to be termed Acting Director of the School of Mines. After a change of government, in 1930, Lynch and the State Mining Engineer, A.H. Howe (q.v.), were commissioned to conduct an investigation into economies that could be recommended at the School of Mines. The investigation was considered in Kalgoorlie to be an affront to Butement and caused further popular reaction. The government accepted a compromise solution. On Butement's retirement his successor would be termed the Principal of the School of Mines and would be responsible to Lynch for educational policy and to the Under Secretary for Mines for administrative matters. In the 1930s two branches of the School of Mines were opened at Wiluna (1937) and Norseman (1940) which were under Lynch's control but each had a local advisory committee from the mining industry. Lynch was elected an associate member of the Australasian Institute of Mining and Metallurgy in 1928 and a member in 1939. He retired in 1941.

RDM 1940; WWA 1944 p.529; ArcAusMM; M.A. White, *The Western Australian School of Mines: A History of its Development from 1902 to 1970*, WASM, 1971, pp.17-19, 23-27

## Mac, Mc

**MACARTNEY**, Edward Hussey Burgh BCE, MAusIMM. (d.1930)

An engineering graduate from the University of Melbourne, Macartney arrived in Western Australia in 1894 and established a practice in Kalgoorlie as a licenced surveyor which he maintained until 1921. He was surveyor for Hampton Properties Ltd. and its associated companies in 1918-20 which were the busiest years of the Hampton land boom. On 16 September 1919 Hampton Plains Estate, which was the only land in the goldfields to have rights to minerals (including gold) included in land ownership titles, reported that it had issued 300 gold mining licences and that Macartney was surveying leases at the rate of three per day. Several mines were opened in 1920 and 1921 but by 1923 almost all mining activity had been

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abandoned. Macartney returned to Perth in 1921 and continued his practice there until he died in 1930. He was elected a member of the Australasian Institute of Mining Engineers in 1901. In 1897 he was Mayor of Bulong, which was the township 22 miles north of the Hampton Estate's centrally situated King battery. He was also Mayor on two subsequent occasions. His published papers include 'Diamond drill boring' *TAus/IMM* 81, 1931, pp.51-62

GG 1897 p.535, 1904 p.304; *WArgus* 24 Dec 1896, 30 Dec 1919; Reid pp.84-90; *ProcAus/IMM* 79, 1930, p.Lxxxvii; Mackay, D., 'Hampton Plains Estate', *JHSA* 6-7, 1968, pp.31-41

**McAULAY**, Duncan Fraser MIMM. (c.1866-1935)

McAulay worked in the Thames and Karangahake goldfields in New Zealand, and also in South Australia, before coming to Western Australia where he was manager of Peak Hill Goldfields Ltd (PHGF) at Peak Hill from 1905 until 1907. The British owned company, formed in 1897, was the chief mine at Peak Hill. Its early ore was very rich (yielding three fine ounces per ton in its first year) and in the five years from 1899 to 1903 (inclusive) the mine produced an average of 26 thousand fine ounces per year which was the third highest among mines outside Kalgoorlie. However, in 1903, despite its high production, the mine had done little development and had virtually no reserves. It also had a number of technical inadequacies. Its compressors, for example, were inadequate for powering drills or for ventilation. McAulay's bid to save the mine came too late and in his second year, 1906, production reached its nadir of one thousand ounces, although in the next year he was able to stabilise production at six thousand ounces by obtaining ore from open cuts on the company's other leases. In 1908 it was reported that he went to Queensland to work for three years at Cobar. He returned to Kalgoorlie in 1910, where he was appointed superintendent of Great Boulder Perseverance Ltd (ECGF Boulder) under Ernest Williams (q.v.) who had been general manager of Bewick Moreing & Co. in Western Australia in the 1890s and who had become a partner in Hooper and Speake, mining consultants and mine managers, which had been general manager of Great Boulder Perseverance since 1905. In 1913 McAulay was appointed manager and attorney for Associated GMs (WA) Ltd, after the former manager G.M. Roberts (q.v.) resigned to concentrate on managing the other Kalgoorlie mine of which he was also manager, Associated Northern Blocks (WA) Ltd. McAulay retained the management of Associated GMs until 1925. He was a member of the executive council of the WA Chamber of Mines between 1912 and 1916, and was one of its vice presidents between 1927 and 1931. He was elected an associate member of the Institution of Mining and Metallurgy in 1906, and a member of the institution in 1910. He gave evidence to the Royal Commission on Mining in 1925.

*JCMWA* 1904, 1907, 1910, 1920, 1931; Skinner 1915, 1920; *MCER* Oct 1935, p.474; *TIMM* 45 1935, p.517

**McCRACKEN**, Robert (d.c.1910)

In 1896 McCracken was manager of the mines of Lady Loch GM Ltd and of Forrest King of Coolgardie Ltd, both of which were located at Coolgardie. In the following year a reconstructed company, Lady Loch GMs Ltd, took over the undertakings of the two mines and also shares of Jacoletti GMs Ltd. In 1905 a new company, Loch Mines Ltd, acquired the assets of Lady Loch GMs Ltd. In 1909 McCracken was manager of Leviathan GM Ltd (MMGF) at Burtville which in 1904-08 had produced 342 fine oz of gold from 500 tons of ore.

Skinner 1897, 1909; Reid p.32

**McCULLOGH**, George (b.1877)

McCulloch was born in London and had his schooling there. He studied mechanical engineering at Edinburgh University and served an apprenticeship with Douglas and Grant in Kirkcaldy. After four years working as a draughtsman with Richard Moreland and Sons, he moved to London where he was employed by James Simpson and Company, the manufacturers



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of water supply pumps and associated equipment. He arrived in Western Australia in 1899 to take up the position of mechanical engineer at Kanowna Consolidated GMg Co. (NECGF Kanowna), where he was responsible for the installation and operation of the company's mechanical plant for two years. In 1901 he was appointed chief engineer for Great Boulder Pty GMs Ltd (ECGF Boulder), the foremost mine in Kalgoorlie-Boulder. In 1901 its production of 152 thousand bullion ounces was the third highest of any mine in the state. McCulloch held the position until 1906 when he was appointed Government Inspector of Machinery for the North Coolgardie and Mount Margaret Goldfields. This was a significant appointment from the point of view of mine safety as previous mechanical inspections had been required for boilers only. McCulloch was a foundation member of the Western Australian Institution of Engineers in 1910, but did not renew his membership in later years, probably because of his departmental duties in the goldfields.

His published works include: with C. Futers, *Winding engines and appliances*, Arnold, London, 1897;

'Condensation of steam and the relative economy of various types of condensers' *JCMWA* 1, 1902, pp.403-14;

'The economy of condensation, a reply' *JCMWA* 2, 1903, pp.198-202;

'An improved method of signalling in mines' *JCMWA* 2, 1903, pp.355-61.

Battye 2, p.361; *ProcWAIE* 1-1 1910, p.i, 2-1 1911, p.i; Spillman p.143; RH.Kalg tb 4.1

### **McDERMOTT, George**

George McDermott, the younger brother of Jack (below), graduated from a school of mines in New Zealand with a mine manager's first class certificate and arrived in Kalgoorlie in 1900. He worked as a timber man at Ivanhoe Gold Corporation Ltd (ECGF Boulder) under his brother who was the underground manager at the mine. When Jack moved to manage a mine at Cue George took his place as underground manager, a post he held for six years during which time the tonnage raised increased by 24 per cent. In 1912 McDermott acquired a third interest in the Light of Asia GM (MGF) at Cue. The mine produced £75,000 worth of gold in three years before it was sold to the Mararoa GM Co. which had its principle mine at Norseman. In 1926, McDermott returned to Kalgoorlie and worked a tribute in the Ivanhoe Gold Corp mine for approximately four years.

Reid p.150

### **McDERMOTT, John (Jack)** MAusIMM, MIMS. (c.1866-1940)

A New Zealander, McDermott came to Western Australia in the late 1890s. He was manager of the City of London GMs Ltd (CGF) at Kintore in 1898 and was underground manager at Ivanhoe Gold Corporation Ltd (ECGF Boulder) from 1900 to 1902 when its production of 142 thousand bullion ounces was approaching its peak annual figure and was the fourth highest in the state. In 1903-04 he was manager of Princess (Murchison) Consolidated Ltd. (MGF) at Cue as it was nearing its closure. He was manager, between 1906 and 1912, of the Sons of Gwalia Ltd (MMGF) at Leonora, under the general management of Bewick Moreing & Co. In 1911 the Sons of Gwalia reached its peak production of 70 thousand fine ounces of gold which was the fifth highest annual total in the state and the highest for a mine outside Kalgoorlie. From 1913 until 1917, McDermott was in Rhodesia at the Cam and Motor GM. He returned to Western Australia in 1918 to become manager of Ivanhoe Gold Corporation Ltd until 1920, when it ceased independent production. He then joined Bewick Moreing to manage a mine in Broken Hill. He was elected a member of the Australasian Institute of Mining and Metallurgy in 1909 and joined the Institute of Mining Surveyors in 1916. He gave evidence to the Royal Commissions on ventilation and sanitation in mines in 1905 and on miners' lung disease in 1911-12. After retiring in 1924, he lived in Sydney.

Skinner 1899, 1920; *JCMWA* 1902, 1903, 1905, 1920; *WAMBEJ* 9 Feb 1907, p.7; *MCER* Sept 1917 p.311, Jan 1940 p.142; *CMWA* 1940; *ArcAusMM*

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### **MACGEORGE, A.J.**

Macgeorge was a metallurgist who operated an assay laboratory in Kalgoorlie in 1896. According to M. Maclaren, a prominent British geologist who, in July 1912, investigated the circumstances of the discovery, of the first recognition of Kalgoorlie sulpho-telluride mineral Macgeorge played a significant role in the recognition of the mineral. According to Maclaren, a very high assaying mineral was isolated by Richard Eades, manager of Block 45 mine in Kalgoorlie. After two of his colleagues had showed samples to a small group of experienced chemists and assayers, the representative in Kalgoorlie of the Australian Gold Recovery Co., the holders of the cyanide gold extraction patents, Erle Huntley (q.v.), suggested that the samples might be gold telluride, based on his experience at the Mt Shamrock mine in Queensland where another type of telluride had been found. The following day Huntley took a sample to Macgeorge's laboratory where the identification was confirmed. Subsequently another assayer, A.G. Holroyd (q.v.), claimed to have made the discovery. Although this was untrue, Holroyd was, in fact, the first person to announce publicly news of its discovery in an edition of the *Kalgoorlie Miner*. Macgeorge accumulated sufficient capital to make significant investments in mining developments. In January 1903 he was reported to have been a large shareholder in a new mining venture, Vivien GMg Co. Ltd (EMGF) which had been promoted by Bewick Moreing & Co. at Lawlers, and that he visited the mine shortly after its opening in 1903. The mine operated until 1911 and produced 77 thousand fine oz of gold from 210 thousand tons of ore but paid only one dividend. From 1905 Macgeorge was the Western Australian representative of the British & Foreign Development Syndicate which had been formed by a group of London speculative investors. From 1906 to 1909 he was manager of the Black Hill Development Co Ltd (MGF) which was developing a mine at Mt Magnet which, between 1909 and 1911, produced 9 thousand fine oz from 16 thousand tons of ore.

RH Kalg cp 1.3; Reid pp.92, 283; JCMWA 1905, 1906, 1909

### **McINTYRE, Peter**

Peter McIntyre was one of the small group of industrial chemists who were employed by the Glasgow company Cassel Gold Extracting Company (Cassel) to build demonstration cyanidation plants on the goldfields around the world and to advance the technologies of the cyanide process for the extraction of gold from the tailings of traditional gold extraction plants and from processed ore. After John MacArthur (q.v.) and the Forrest brothers had discovered and patented the cyanide process in 1887-88, McIntyre was one of the first chemists to be employed by Cassel in MacArthur's Glasgow laboratory to test the cyanide process on refractory gold ores from major goldfields. The Ravenswood goldfield in Queensland was adopted for the location of the first cyanide process demonstration plant as Cassel already had a works there and samples of the refractory Ravenswood ore had been tested in Glasgow. In April 1888 McIntyre was chosen to undertake the Ravenswood venture and, after further training, he and his brother sailed for Queensland. By December 1888 the cyanide plant was ready for operation and in that month the first gold ever produced on any goldfield by the cyanide process was banked by McIntyre. The absence of patent protection for the process in Queensland restricted the scope of his activities but, from December 1888 to the end of 1891, the Ravenswood works treated 1257 tons of ore and residues to produce 1300 oz of fine gold. The average extraction rate from the highly refractory material was 85.6 per cent and in a public trial at Ravenswood in February 1891, in which difficult-to-treat concentrates from several mines were processed, the average extraction rate was over 90 per cent. In August 1888 Cassel agreed with the New Zealand Crown Mines Ltd to erect a cyanide plant at Crown Mines' Karangahake mine and in early 1889 McIntyre travelled to the mine to assist in setting up the plant. The first commercial extraction of gold using the cyanide process occurred at the mine in June 1889. Filter presses were used but operations were restricted due to lack of water.

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In 1889 a group of Australian businessmen proposed that an Australian company be formed to manage the cyanide patents in Australia and to promote the process. After protracted negotiations, in 1892 Cassel formed the Australian Gold Recovery Company (Aust GRC) with the main Australian office in Adelaide but with its main activities still in northern Queensland where Charters Towers had become the main goldfield. Expansion of the cyanide process at Charters Towers was slow, so in 1895 McIntyre was transferred to Western Australia where the Eastern Goldfields were rapidly expanding. In 1895 only four cyanide plants were operating in the colony and in 1896 there were ten including the first in Kalgoorlie, at Hannan's Brownhill GMg Co. However by the end of 1897 there were 79 in operation about half of which were in Kalgoorlie.

In 1896, shortly after his arrival in the colony McIntyre was involved in the first identification of telluride of gold in Kalgoorlie. High assaying samples taken by Richard Eades, the manager of Block 45 mine (ECGF), were shown, on 24 May 1896, by two of his colleagues to Erle Huntley (q.v.) who, based on his experience in Queensland, suggested that the sample could be gold telluride, an opinion which he confirmed with a blow-pipe test in A.J. McGeorge's assay laboratory the following day. Later that day he advised McIntyre. On 27 May Eades sent further samples for identification to another assayer, A.J. Holroyd (q.v.). With McIntyre's help Holroyd proved by rigorous tests that the sample was telluride and on 29 May advised the press. Holroyd's letter was published in the *Kalgoorlie Miner* on 1 June 1896.

When Lake View Consols began work on establishing a cyanide plant for treating tailings from oxidised ore in January 1897, McIntyre, as the state representative of Aust GRC, assisted John Sutherland (q.v.), the company's metallurgist, in planning and setting up the plant. McIntyre's work must have impressed Callahan (q.v.), the Lake View manager, as, in February, McIntyre was engaged as the mine's cyaniding superintendent. Three weeks later came the announcement that a trial filter press for slimes treatment had been ordered from England. Meanwhile, work proceeded on the cyaniding by percolation of the tailings sands which was eventually successful in August. In the same month the prototype filter press was set up and, in September, Richard Hamilton (q.v.) of Great Boulder reported that the press was working 'like a charm'. Lake View started investigating treatment of its sulphide ores in 1898 and chose the dry crushing and roasting method. Two American straight line reverberatory furnaces were built but, when the plant was commissioned in 1899, problems arose in the cyanide leaching of the roasted ore which suggests that McIntyre was no longer working for the company.

Lougheed pp.11-13, 20-23, 32-35; RH.Kalg chs 1.3, 2.3

**McKEOWN**, Maurice Robert MAusIMM, MAMIMME. (b.1885)

McKeown was employed by Broken Hill Proprietary at Broken Hill in 1904 and subsequently worked as mill superintendent for Phillips River Gold and Copper Company (PRGF) at its Ravensthorpe copper smelter under G.C. Klug and F.W. Morgan (qq.v.). He returned to Broken Hill in 1911 and later moved to Melbourne where he worked for Victor Leggoe and Company. In 1923 he established a consultancy practice as a mining engineer and in the late 1930s was consulting engineer for Blue Spec GM Ltd at Nullagine (PGF). In 1925 the proponents of the mine submitted samples of the antimonial gold ore from the mine to the Mineralogical Laboratory of the Western Australian School of Mines to determine whether the ore could be effectively treated by flotation. Messrs Winter and Moore (qq.v.) of the Laboratory carried out preliminary tests and indicated that there was a possibility of removing a high percentage of the gold and the bulk of the stibnite as a concentrate. In 1939, when development of the mine was again being considered, McKeown submitted further samples to the Laboratory for more detailed investigation which led to the adoption of flotation by the mine for the recovery of gold and antimony from the comparatively high grade ore. In 1955 McKeown was consulting engineer for the Lancefield GMg Co. (MMGF) at Laverton. He was elected a member of the Australasian Institute of Mining and Metallurgy in 1912 and was the

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correspondent of the Institute for Kalgoorlie in 1950. He was in Victoria in 1961. His writings include 'Notes on the Phillips River Gold and Copper Field', *ProcAusIMM* 27, 1917.

CMWA 1935; Rep Met Lab Kal 1 Dec 1927, 189 Dec 1939; *CEMR* Oct 1946, pp.13-14

### **MACKINNON**, Godfrey William Wentworth

In 1896 Mackinnon was at Great Fingall Reefs Ltd (MGF Day Dawn), which was later incorporated into Great Fingall Consolidated Ltd. He was manager of Bayley's United GMg Co Ltd (CGF Coolgardie) from 1897 to 1900. After Whitaker Wright was bankrupted by a bear attack on the shares of Lake View Consols and the mine's manager H.C. Callahan (q.v.) was recalled to London, Thomas Hewitson (q.v.) was appointed temporary manager to restore public confidence in the management of the mine. In April 1900, Mackinnon was appointed Lake View's new manager and Hewitson retired. Mackinnon left for London in November 1900 to confer with the new group of directors, under F.A. Govett, which had taken control of Lake View Consols after Wright's departure. When Mackinnon returned to Perth he announced his retirement and after Govett arrived in Perth, in January 1901, Govett announced that Bewick Moreing and Co was to be the new manager of the mine. Mackinnon moved to London in c.1905 and established a mining consultancy practice. He was a director of Amalgamated Zinc (De Bavay) in 1915, of Lake View and Star Ltd in 1920 and of Austral Gold Development Ltd, Austral Metals Ltd, and Goldfields of Australia Development Ltd. in 1940. He was in Austria at the start of the 1914-18 War and was interned as an enemy alien but was returned to Britain in May 1915.

WAGC 1 Aug 1896 p.10; Skinner 1897, 1900, 1915, 1920; *JCMWA* 1902, 1920; *MYBA* 1940, p.124; *MMg* Jan 1915 p.21, May 1915 p.261

### **MACLEOD**, William Alexander BA, BSc, MIMM, MAusIMM (1874-1946)

Born in Dunedin, MacLeod graduated from Otago University (BA, BSc) and from its School of Mines in 1897 with an associateship in mining and metallurgy. After working in the New Zealand mining industry for several years he was appointed assistant director of the Thames School of Mines in New Zealand and was put in charge of experimental ore treatment. In 1899 he moved to the University of Tasmania as director of a provisional course in mining engineering and then went to Queensland to become director of the Charters Towers School of Mines. In 1903 he was appointed manager of the Brilliant Extended Gold Mine in Charters Towers and became general manager of that company's operations in Queensland in 1905. After moving to Western Australia in 1912, he joined Bewick Moreing and Co., mining consultants and mine managers, and became general manager of its Western Australian branch in 1914. From 1912 to 1916 he was manager of Lake View and Oroya Exploration Company. This company, which had been formed by Herbert Hoover in 1912, amalgamated the investment and exploration branches of two groups formed from Lake View Consols and Oroya Links. MacLeod managed the new mines which had been developed by the exploration branches, the most significant one of which was in Meekatharra. Hoover's main interest in the company was its value as an investment vehicle. In 1917 MacLeod moved to London where he became a partner in Bewick Moreing and Co. He was a vice-president of the Chamber of Mines between 1913 and 1916 and was an honorary member of the Chamber from 1917 to 1920 (one of only four).

His published papers include:

'Surface condensers in mining power plants', *TIMM* 19, 1909, pp.332-84;

'The Charters Towers Goldfield Queensland', *MER* Oct 1911, pp.5-12;

'Gold mining and war profits taxation' *JCMWA* 1916, pp.220-23;

(With J.P. Wood) 'The steam consumption of air compressors: Some tests, with remarks thereon and suggestions for the standardisation of specifications', *TAusIME* 12, 1908, pp.165-80;

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'Some air compressor tests' *TAusIME* 13, 1909, pp.59-60.

Clark p.28; Battye 2, p.339; *MER* Aug 1912 p.402, June 1913 p.352; *JCMWA* 1913, 1932, 1936; *MMg* June 1946, p.379

### **McNEILL**, William MIMM, AMICE

McNeill was the metallurgist employed in England from 1896 by Bewick Moreing & Co., mining consultants, to investigate the suitability of existing proprietary equipment for the processing of dry crushed gold ore mined at Hannan's Brownhill GMg Co Ltd (ECGF Kalgoorlie). On 18 May 1898 McNeil gave an influential paper to the Institution of Mining and Metallurgy in London, titled 'Filter-press treatment of gold ore slimes (Hannan's, West Australia)' in which he described the first use of filter presses in Kalgoorlie-Boulder (in early 1897). The mix of slimes and cyanide were forced by compressed air into the battery of filter presses through which water was forced removing the gold in solution. The filter presses initially used at the Brownhill mine were manufactured by the British company S.H. Johnson & Co., a company which made filter presses for the sewage treatment industry. The Johnson presses were later superseded in Kalgoorlie by ones made originally for the sugar beat industry by the German company R. & G. Deyne. All the major Kalgoorlie mines adopted filter presses and made their own adaptations and procedural changes to their use. In 1906 McNeil was general superintendent of Bacis Gold and Silver Mining Co. Ltd. which operated mines in the vicinity of Bacis in the Mexican Sierra Madre mountains. Later in 1915-20 he was consulting engineer to the company. Also in 1915-20 he was consultant for Menzies Consolidated GM Ltd (NCGF) which by 1920 had produced 240 thousand fine oz of gold. His filter press paper was published in *TIMM* 6, 1897-98, pp.247-69.

Skinner 1906, 1915, 1920; RH Kalg cp 2.3

### **McTEAR**, James A.

McTear joined Bewick Moreing & Co., mining consultants and mine managers, in the United Kingdom for service in Australia. He arrived in Western Australia in 1895 to become an inspecting engineer assessing the suitability of new mines and prospects for development as company mines, most of which were in the Eastern and Murchison Goldfields. By the end of 1901 he had made over thirty inspection expeditions many of which included inspections of three or more prospects located within the same region. In 1902 Bewick Moreing appointed McTear manager of East Murchison United Ltd (EMGF) at Lawlers. He was working there when Herbert Hoover visited the mine in 1902 during his first tour of the mines managed by Bewick Moreing after he had been made partner responsible for mines managed by the company. McTear was at the mine for a year.

McTear's father (or close relative) **James McTear** (Senr) was President of the Institution of Mining and Metallurgy in 1896-97. In 1896 he visited Western Australia while James A. was working as an inspecting engineer. In McTear's Presidential address he discussed at length the goldfields of Western Australia and included production statistics to the end of 1896 (*TIMM* 5, 1896-97, pp.182-211).

Dept Mines Bewick Moreing Report Collection; *JCMWA* 1902; L. Hoover diary Jan 1902, Hoover Pres Lib

### **McVEE**, Robert AMIEAust. (1878-1940)

McVee worked in the coal mining industries in New South Wales and Victoria before succeeding T.D. Briggs (q.v.) as Inspector of Mines for the Collie Coalfield in 1911. He gave evidence to the Royal Commission on the Collie Coal Industry in 1916 and was appointed mining engineer and manager of the Premier Coal Company at Collie in 1920. In the same

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year he became a foundation member of the Institution of Engineers Australia. He represented the Amalgamated Collieries WA Ltd. at the Royal Commission into the Mining of Coal at Collie in 1940, but died before the enquiry ended.

PSL 1915; 'RRC Collie Coal Industry' V&P WA 1916-7, 14; 'RRC Coal Supplies and development of Collie Coal Field' V&P WA 1940, 20; Stedman p.223

## M

**MANNERS**, Joseph Edward AWASM, MIMM, MAmIMM, MAusIMM. (c.1897-1961)

Manners was educated at St Peter's College in Adelaide and at St Paul's School in London. After serving in the King's Royal Rifle Corps during the First World War, Manners joined Ivanhoe Gold Corporation (ECGF Boulder) in 1920. He was head sampler at Boulder Perseverance Ltd (ECGF Boulder) after its reconstruction in 1923 and subsequently was also acting surveyor. In 1927, he was awarded an associateship in mining and a mine surveyor's certificate by the Western Australian School of Mines. In the following year he was appointed the local manager of Carabobo Venezuela GM Ltd. and, in 1929, he joined the Rio Tinto Company in Spain as deputy manager of the Alfredo underground mine which was reached by an adit from the main Rio Tinto open cut. As civil war threatened, in 1935, Manners returned to Western Australia where he became general manager and attorney of Boulder Perseverance Ltd. He was also chairman and managing director of Kalgoorlie Enterprise Mine Ltd (ECGF Kalgoorlie), a company which Boulder Perseverance acquired from Broken Hill Pty in 1937 to work the Enterprise group of leases to the north-west of the Boulder Perseverance lease. In addition, he was attorney of Kalgoorlie Ore Treatment Company Ltd (ECGF Boulder), a company which had been formed in 1933, by Boulder Perseverance and North Kalgurli (1912) Ltd, to treat the ore mined by the two companies (and later also that of Kalgoorlie Enterprise). Manners was a director of Umtali Mines Ltd. in Rhodesia and a partner in the mining consultancy of W. Broadbridge and Partners in London. He was also a director of Gold Mines of Kalgoorlie Ltd. between 1954 and 1956, and of Cable (1956) Ltd. (miner of ilmenite) in 1959. He was elected a member of the Australasian Institute of Mining and Metallurgy in 1948 and was a vice-president of the Western Australian Chamber of Mines in 1951-55.

MCER July 1937 p.390, Feb 1956 p.159; MYBA 1940, 1951; CMWA 1940, 1955; Lloyd p.92; L.Clark pp.113, 229; ArcAusMM

**MANNERS**, William George ABalSM, MAusIME (1863-1924)

William Manners was born at Scarsdale near Ballarat in Victoria. While working at the Phoenix Foundry, he studied part time for seven years at the Ballarat School of Mines from which he received, in 1886, one of the first engineering certificates issued by the School. He moved to Broken Hill where he was appointed engineer for Broken Hill Pty Block 14 Co. Ltd and, in 1891-93, for the Tarrawangee Flux and Tramway Company which quarried limestone for use as flux at the Broken Hill mines. After taking part in a prospecting expedition around Arltunga in the Northern Territory, Manners arrived in Kalgoorlie in 1895. Martin of the Gawler mining machinery manufacturer had recommended his employment to Charles Kaufman (q.s.) of London and Globe Gold Corporation and Kaufman appointed Manners manager of the Gold Crown mine at Kanowna (NECGF). He worked there for a year during the establishment of the mine and then resigned to set up his own business as a mining engineer and contractor. However, as the demand for new works at Kanowna was diminishing, he returned to Kalgoorlie where he accepted an offer from London and Hamburg Gold Recovery Co. to work as a treatment plant design engineer. London & Hamburg GR Co. was the holder of the bromocyanide gold treatment patents and was

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developing the Diehl process for the treatment of the Golden Mile sulpho-telluride ore under its chief chemist, Ludwig Diehl (q.v.). While at London and Hamburg Manners worked on the design of the conversion of the oxidised ore treatment plants of both Lake View Consols and Hannan's Brownhill to sulpho-telluride ore treatment plants using the Diehl process. He worked at London and Hamburg for a year before leaving to join S.G. Turrell in the contracting company, Turrell and Manners (Turrell's former partner Kay having retired). In 1901 the company obtained a contract from Golden Horse-shoe Estates, Kalgoorlie's largest gold producer,

to prepare the detailed drawings for, and to build, its No.1 sulphide ore mill which was a conversion of its 50 head oxidised ore mill. It was opened in April 1902 and, later in 1902, work started on new 100 head stamp mill called No.2 sulphide mill for which Manners also did the detailed drawings. The mill included Edwards Duplex furnaces to treat the concentrates (which previously had been sent to the Fremantle smelter). The No.2 Mill of 1906 was probably the most advanced version of stamp mill treatment in Kalgoorlie. In 1901-02 Turrell and Manners also had the contract to do the detailed drawings for, and build, the King Battery on Hampton Plains, a 20 head battery and treatment works with a capacity to treat 100 tons per day. In 1904 the company, Turrell and Manners, was dissolved and Manners re-established W.G. Manners & Company and practised as a mining engineer, draughtsman and patent attorney in Kalgoorlie. From 1904 he was the only registered patent attorney on the goldfields, the other two ones in the state having offices in Perth. From 1904 to 1922 he registered 160 Commonwealth patents (18% being provisional), 104 of which were related to mining and metallurgy, the commonest categories of these being filtering machines (21), rock drill bits (12) and roasting furnaces (8). A number of the patents he registered were of international significance, including the 5 by G. Ridgway (q.v.) relating to vacuum filters. For some of these Manners also took out Transvaal (15) and Mexican (7) patents. He also did patent investigations for clients and took out three sealed patents in his own name.

In 1906 Manners, as secretary for a group of investors, floated a new company Light of Israel GMG Co which developed a mine at Davyhurst (NCGF). Over ten years the mine produced 1093 fine oz of gold at a yield of 5 dwt per ton.

In the same year Manners designed the refurbishment of the plant for North End GM (ECGF Kalgoorlie) which was adopting an all-sliming treatment process and was one of the first mines, apart from Great Boulder Pty Ltd, to adopt the Ridgway Mk.1 automatic vacuum filter. In the following year, he designed and supervised the erection of the plant for a new company, Sons of Gwalia South Ltd (MMGF, Leonora). Like the established Sons of Gwalia Ltd, it was floated by Bewick Moreing's agency company, London & Western Australian Exploration Co. Ltd. The new mine, whose leases were to the south of those of the Sons of Gwalia, operated independently for a number of years before being eventually absorbed by the parent company. In 1908 Manners designed a new treatment plant for St Georges GM (MGF Mt Magnet) which was owned by Boulder No.1 Co. of Kalgoorlie. Following the trend in Kalgoorlie operations the treatment plant was an all sliming plant and was one of the first to use Ridgway Mk.2 vacuum filters. These operated at a much slower speed than the Mk.1 type but had a greater capacity and could be adjusted more readily for variations in slime composition. In 1909 Manners travelled to central New South Wales to design a new plant for Cobar GMs and a reconstruction of the treatment plant of Occidental GMG Co.

In 1910 Manners bought land near Denmark in south-western Western Australia and started the development of a farm but, in 1911, he accepted an offer to design a large mining plant in Rhodesia for a London company, Cam and Motor Mines. Leaving the farm's development to one of his sons, he travelled to the company's head quarters in London and then to Rhodesia to study the mined ore and conditions at the mine. He returned to London to prepare the plans and specifications for the mine, then to let contracts for the machinery and to inspect its manufacture. Returning to Rhodesia he supervised the installation of the machinery and returned to Western Australia in 1913. The farm had not been a success and Manners returned to his engineering and patent practice in Kalgoorlie. In 1913 he designed new machinery and a

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poppet head for Riverina South Leases at Mulline (NCGF) and, in 1914-15, he was responsible for design and installation of machinery and treatment plant for a new mine, Ida H Ltd at Laverton (MMGF). Subsequently his practice involved mainly the redesign and relocation of existing mines and plants. He was elected a member of the Australasian Institute of Mining Engineers in 1909. He was a member of the Kalgoorlie Municipal Council until 1922 when he retired through ill health. He died in 1924.

His published papers include: 'Facts about inventions', *KM* 19 Jan 1906; 'Power transmission', *WAMBEJ* 3 Mar 1906; 'Electric mine signalling', *WAMBEJ* 17 Mar 1906; 'Mechanical appliances used on the mines of Western Australia', *JCMWA*, 8, 1909, Part 1, 'Launderers, rope haulage, flying fox', pp.14-23: Part 2, 'Push conveyors, weighing feeder, conveyor belt automatic tripper', pp. 59-68. In 1904 he registered in his own name provisional Commonwealth Patent 508 for an 'improved centrifugal filter' which he did not complete. In 1909 he registered Commonwealth Patent 14264 for the 'treatment of auriferous and argentiferous ores' which was not renewed. Also in 1909 he registered Commonwealth Patent 14625 for 'an improved centrifugal filtering machine' which was renewed in 1916.

*JCMWA* 1905; *WAMBEJ* 1 May 1909, p.4; R.B. Manners, *So I headed West*, Kalgoorlie, 1992, pp. 109-21, 149-51, 173-76, 210-11, 266-72; Patent Register of W.G. Manners

### **MARRINER**, John Taylor MIMM, MIMMAmer, MAusIMM

Marriner was a pupil with John Stuart and Company at its Blackwall Iron Works in London, and studied at University College, London. After a period working as an assistant demonstrator at the College, he joined Cassell Gold Extracting Company in Glasgow as a trainee cyanide metallurgist. The Cassell Co. was the holder of the MacArthur-Forrest patents for the cyanide process and ten years after its discovery in 1887 ten per cent of the total world gold production was produced by means of the cyanide process. The speed with which it was taken up by gold mining companies was largely due to the activities of Cassell-trained metallurgists demonstrating the process on the goldfields. Men like Marriner were trained in cyanide usage in Cassell's Glasgow laboratories where they also tested the process on various refractory ores. Unlike the first Cassell-trained metallurgists who were sent out to the goldfields to represent the company Marriner did not go to Australia in 1897 as a Cassell representative, although he may have been recommended by Cassell to his future employer. His first job in Western Australia was as a metallurgist for Blackett's Mines Ltd at its Eureka GM which was at Bardoc (BAGF). Its product grade in 1898 was 1.0 fine oz per ton which was almost the same as the average grade for the state's total production at that time. However, the mine had very few reserves and closed after only two years. Marriner was next employed in 1898 as metallurgist at Great Boulder Main Reef Ltd (ECGF Boulder), a small mine adjoining the southern end of the leases of Great Boulder Pty. The company had mined nearly all its oxidised ore and was planning to build a plant to treat its sulpho-telluride ore based on dry crushing, roasting and cyanidation by percolation similar to those already built by Lake View Consols and Associated Gold Mines. Marriner was sent by the company to the eastern colonies to inspect roasting furnaces and it was on his recommendation that a multiple-hearth tower furnace was built which was similar to the type built by G.R. Richards for the Mount Morgan gold mine in Queensland. The furnace, which was 9 m by 4 m, in plan, and 20 m high, was the largest structure yet built on the Golden Mile. It had eleven near-horizontal hearths and one fire box at the bottom of the tower from which the hot air rose up the tower, crisscrossing it to pass through flues at the opposite ends of alternate hearths. The ore was introduced from the top and built up until it slid across the furnace to drop to the next level. At Mt Morgan Richards had provided hand rabbling and agitation of the ore by compressed air on each hearth but Marriner had omitted any provision for rabbling. Without it compressed air was insufficient to prevent the ore from sticking to the hearths and attempts to add rabbling by means of external scaffolding failed. Eventually, after the shape of the hearths had been altered the furnace became operable. The post-roasting plant was no more successful than



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those of Lake View and Associated but Marriner quickly and radically reconstructed it in the form of what was to become the standard method of post-roasting treatment – grinding the roasted ore to slimes, agitation with cyanide and filter pressing. The main features of this process were adopted by the majority of mines on the Golden Mile which chose dry crushing and roasting in preference to wet treatment methods. Moreover these features remained virtually unchanged for another 30 years, although considerably modified in detail. Several commentators attempted to name the complete process the ‘Marriner process’, but the terms, ‘dry crush, roast and sliming process’ were the ones generally adopted. Although the Great Boulder Main Reef plant was a technical success the company had made a fundamental error in building an expensive plant before proving it had sufficient reserves to ensure that it could be operated profitably. The company paid no dividends after 1901, was restructured twice and was wound up in 1910. Marriner was made its manager in 1901 but left in November 1902 to become for a short time manager of East Murchison United Ltd (EMGF Lawlers) for Bewick Moreing & Co. but returned to England in January 1903 to become acting manager of a British company which had mineral concessions in Korea. In 1907 he joined Duff Development Company Ltd in the State of Kelantan, Malaya, where it had concessions for minerals and operated gold dredging. In 1911 Marriner became general manager of Pahang Consolidated Ltd. which had mineral concessions and operated tin mines in the State of Pahang. He was in England in 1929, and lived in the Channel Islands after retiring in 1933. He was elected a member of the American Institute of Mining and Metallurgy in 1901, and a member of the Institution of Mining and Metallurgy in 1907. He was an associate of the Chamber of Mines of Western Australia between 1913 and 1920.

WArg 5 Jul 1901; JCMWA 1902, 1913, 1920; Skinner 1903, 1915, 1920; IMM Bull 477, xv; RH.Kalg, ch 4.3; Reid pp.281, 284

### **MARRIOTT**, Frederick Armidale ABalSM, AMIMM. (1880-1918)

Marriott started work in the treatment plant of the Sunlight GMg Co in Hillgrove, NSW, in 1899. He studied for three years from 1900 at the Ballarat School of Mines where he obtained a diploma and associateship in mining engineering. After spending four months doing experimental work in the School's laboratory Marriott spent five weeks working in the mill of BHP's silver-lead mine at Broken Hill and ten months employed as a draughtsman and survey assistant at the Wallaroo and Moonta Mining and Smelting Co. in South Australia. In 1905 he moved to Western Australia and was employed by Bewick Moreing & Co., engineering consultant and mine manager, as assayer and metallurgist in the mill and cyanide plant of Cosmopolitan Proprietary Ltd (NCGF at Kookynie) of which Bewick Moreing was the general manager. Although the Cosmopolitan had past its peak annual production, the 34 thousand fine oz of gold it produced in 1905 was the state's fifth highest for a mine outside Kalgoorlie. In 1908 Marriott was transferred by Bewick Moreing to become the metallurgist at Lancefield GMg Co. Ltd (MMGF at Laverton). From 1904, when its agency company first acquired the mine Bewick Moreing planned to develop it as a model for future large scale mining of low grade deposits. However the significant arsenopyrite content of the sulphide ore had not been allowed for in the treatment plant design and major losses were made in its treatment. The company was reconstructed in 1908 and the sulphide plant was rebuilt (with Marriott's participation). The new process was technically successful but it could not be operated at a profit and the mine was closed in 1910. Marriott was metallurgist at three other Bewick Moreing managed mines, Lake View Consols Ltd (reconstructed) during the formation of Lake View and Oroya Exploration Ltd in 1911, South Kalgurli GMs Ltd (ECGF Boulder) in 1912 and Mountain Queen Ltd (YIGF Marvel Loch), 19 miles south of Southern Cross, in 1912-13. In 1913 Marriott moved to Rhodesia where he worked at Willoughby's Consolidated Ltd. In the following year he transferred to the Cam and Motor GMg Co at Eiffel Flats. In 1916 he joined the staff of the Golden Kopke Mine at Lomagundi. At the end of 1918 he died of

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influenza in Rhodesia, at the age of 38. He was elected an associate member of the Institution of Mining and Metallurgy in 1913 and was made an associate member of the Western Australian Chamber of Mines in the same year.

*JCMWA* 1908, 1913, 1918; *TIMM* 29, 1919, pp.431-32

### **MATHEA**, Constantin Franz

Mathea studied at Beuten School of Mines in Poland and, in 1880-82, did further engineering studies in Breslau where he subsequently practised as a civil engineer. He emigrated to Charters Towers in Queensland in 1884 and moved to Western Australia to work at Kanowna (NECGF) in 1899. He established an engineering practice in Boulder and, in 1906, erected a cyanide plant for Mikado GM Co. Ltd (MMGF) at Burtville. From 1908 to 1912 he was manager of the mine and in 1910-12 was its owner. The Mikado GM produced 9.1 thousand fine oz of gold from 11.4 thousand tons of ore in eight years. Mathea gave evidence to the Royal Commission on Miners' Lung Disease in 1911.

*JCMWA* 1910; 'RRC Miners' Lung Disease' V&P WA 1911-12, A6

### **MATHERS**, John Victor (Vic) Woods MAusIMM (1877-1940)

Born near Stawell in Victoria, where his father was a local authority engineer, Mather graduated from the Victorian School of Mines and was a lecturer at the Stawell School of Mines for a year in 1899. He joined the Western Australian Department of Mines in 1900 and became superintendent of the state battery at Norseman, a position he held for seven years. In 1907 he was appointed manager of the Northern Star GM (DGF Norseman), owned by Westralia Waihi Co. and also became part-owner of Viking Leases No.1 (DGF Norseman). In February 1913 he took over management at Mararoa GM Co. (DGF Norseman) and, in 1919, the company acquired the Light of Asia GM (MGF) at Cue and Mathers transferred to that centre. Other mines in the district were sampled and under Mathers' supervision exploration and development work was carried out from 1924 at the EMU group of leases at Reedy's Find (MGF), 56 km from Cue. A company operated by H.E. Vail (q.v.), New Occidental Syndicate, took over an option and continued the exploration which was subsequently taken over by Western GMs NL (later part of Western Mining Corporation). The exploration continued to be directed by Mathers who, in 1933, joined Western Mining Corporation. The drilling results proved satisfactory and, in September 1933, Triton Gold Mines NL was formed to open up and equip the mine. Western Mining established its headquarters in Kalgoorlie and Mathers was appointed office manager, a position he held until his death in 1940. He was elected a member of the Australasian Institute of Mining and Metallurgy in 1914.

GG 1907, p.163; *JCMWA* 1916, 1920; *RDM* 1924 p.57; Reid p.68; *CMWA* 1934-35; Colless p.142. *MCER* Jan 1937 p.173, July 1940 p.368; L.Clark pp.14, 36

### **MERCER**, W.A. AMICE, MAusIME

Mercer was an English mining engineer who was born in India and worked as an engineer in Assam before coming to Australia. He arrived in Coolgardie early in 1894 and worked as an engineer inspecting mining prospects for Bewick Moreing & Co, mining consultants and mine managers. He became a junior partner in the company after Edward Hooper (q.v.), the Australian resident partner of the company, arrived in Coolgardie in September 1894. An important early acquisition made in June 1894 by Mercer, for Bewick Moreing's agency company, were the two Brown Hill leases (ECGF Kalgoorlie leases 165 & 596) which were floated as Brown Hill GMg Co. On these leases the typical Boulder auriferous diorite lodes were first identified and the rich Oroya shoot discovered. Another significant purchase made by Mercer, in December 1894, on behalf of West Australian Goldfields Ltd, a company associated with Bewick Moreing, was McAuliffe's Reward Claim at Kanowna (NECGF) which was floated as White Feather Reward Claim Ltd. In December 1894 Mercer

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submitted a proposal to the WA Government on behalf of Bewick Moreing that the company build a large centralised ore treatment plant on the River Avon near Northam and that the company be permitted to build tramways from the mines to the government railway to Coolgardie (then still under construction), and also to pump or rail water to the mines. Opposition on the goldfields to the granting of any such 'private monopoly' was so extensive that the scheme was not accepted. However, a similar smaller scheme was later built in 1896, based on a treatment works at Seabrook, near Northam, for which Bewick Moreing was consultant and eventually operator, but it was a commercial failure (see Vanzetti). In 1894 and 1895 Mercer made at least six expeditions to inspect mining prospects over a wide area and also employed other engineers on behalf of Bewick Moreing to make other inspections. In October 1895 he was the founding secretary of the Coolgardie Chamber of Commerce. Hooper reported in 1895 that Mercer had been 'involved in some dishonesty in the purchase of some mining properties'. He was recalled to London to reimburse the company and left Coolgardie on 26 October 1895.

WAGC 15 Sept 1894, 22 Dec 1894, 1 Aug.1896; F.Cammilleri, *Chasing the Weight*, 1986, pp.42, 60; DMP Bewick Moreing report collection; A.&B. Fleming (eds), *Letters of W.F.De Mole*, Letter 3, EGHS Lib.; Reid p.189; A.L. Milhinch, *Seabrook Battery*, 1993; Hooper, Battye LPA; Webb, M&A pp.193-94

### **MITCHELL**, Deane P.

Mitchell studied mining engineering and geology at Stanford University in 1892-96, graduating with an AB in Geology, the same degree as was awarded to Herbert Hoover (q.v.) the previous year. Mitchell was the first of the American engineers to be recruited by Hoover to work for Bewick Moreing and Company in Western Australia, arriving in Coolgardie in September 1897. On 1 November he was installed as the new manager of the East Murchison United Ltd mine (EMGF) at Lawlers, under Hoover who was the acting district engineer. The two young Americans instituted a number of 'reforms' before the workforce could unionise. The forty-four hour week was extended to one of forty-eight; single hand drilling was introduced; shifts were changed underground and 'more skilled' miners were introduced. When miners struck over single hand drilling Mitchell replaced them with Italians ('the more skilled miners'). After two years at Lawlers Mitchell was transferred to New Zealand to become manager of Talisman Consolidated, an established North Island gold mine, and also to act as Bewick Moreing's general manager in New Zealand. In 1903 he was appointed the company's manager of the Loddon Valley deep leads project in Victoria. This was a major pumping exercise in which over three million gallons per day were pumped from underground rivers in an unsuccessful attempt to access alluvial gold in the rivers. He returned to Western Australia in 1907 to become superintendent of Oroya Brownhill Co. Ltd. (ECGF Boulder) which had been formed in 1902 by an amalgamation of Hannan's Brownhill GMg Co Ltd and Hannan's Oroya GMg Co WA Ltd, but which by 1907 had limited reserves. In August of the same year, Mitchell was transferred to Broken Hill to become Bewick Moreing's superintendent of the Zinc Corporation's tailings treatment operations. The Zinc Corp had been formed in 1905 by Bewick Moreing and the Melbourne-based Collins House group, to purchase large quantities of zinc-rich tailings produced by Broken Hill mines and to extract the zinc from them using one of the flotation processes being developed. However, the Zinc Corp had not yet determined which, if any, of the processes could successfully do this. Attempts to use the Potter process and then the Cattermole one proved to be expensive failures, sending the Zinc Corp to the verge of bankruptcy. Mitchell was instructed to install a revised version of the Elmore process (known as the 'Elmore vacuum' process). After a race against time, the Elmore process began operating in February 1908 and was greeted as an outstanding success. In May 1908, 3,600 tons of zinc concentrates were produced and by July the company was making a profit of £4,000 a month. At the Zinc Corp's AGM Mitchell was praised as having 'that unusual combination of high technical skill and commercial common sense'. The Elmore process did, however, have a drawback. Although it successfully concentrated tailings which had a high zinc content, it was incapable of dealing with tailings containing a low

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percentage of zinc. Mitchell recommended to Govett, the Zinc Corporation's joint managing director, that the company replace the Elmore process with the flotation process developed by Minerals Separation Ltd. His suggestion was implemented in 1912 and the new process proved completely successful. Meanwhile, in 1910, Mitchell had been moved to southern Queensland to become manager of Great Fizroy Mines, a copper and gold mine and smelter the management of which Bewick Moreing had recently taken over. In the same year the London Board of the mine had instructed its Australian board to install a Minerals Separation plant at the mine. Mitchell was not in favour of this as a new gravity separation plant had just been installed at the mine and the additional cost of its replacement with a flotation process would affect the profitability of the mine which, because of the low copper price at the time, was already only marginal. Moreover, although Mitchell was convinced of the success of the Minerals Separation process in producing zinc concentrates from silver-lead tailings he doubted about its effectiveness in concentrating the copper and gold ore. The process proved to be only partially successful.

In 1912 Mitchell resigned from his position with Bewick Moreing and moved to London where he established his own consulting engineering practice. He worked in association with a number of other independent consulting engineers, mainly Americans, a leading member of which was Herbert Hoover (q.v.). It was Hoover who introduced Mitchell to Leslie Urquhart, a Scottish entrepreneur with Russian connections who was developing mines in the Ural Mountains and in Siberia. From 1909 Hoover had assisted Urquhart in the London financing of the Kyshtim and Tanalyk Corporations to develop copper mines and smelters in the central and southern Urals. In 1913 Mitchell went for six months to Siberia for Urquhart to investigate potential mining properties and, in consequence, Urquhart successfully obtained from the Tsarist government three very large mining concessions, covering over thirteen thousand square miles, which included the Ridder area near the Mongolian border which contained large, very rich, silver/lead/zinc deposits. In the following year, to secure two of the Siberian concessions Urquhart launched in London the Irtysk Corporation, capitalised with over two million pounds and with Hoover and Mitchell included as directors. Later in the year Mitchell and two other American engineers went to the Ridder mines to supervise the erection of a concentrating mill.

From the commencement of war in 1914, Mitchell and a small group of engineers became involved in closing down Hoover's business affairs as he became head of the humanitarian Commission for Relief in Belgium and resigned his directorships and sold most of his shares. In 1916, Mitchell arranged for a proportion of his future directors' fees to be transferred to Hoover. Urquhart's Russian operations, after early disruptions caused by the loss of much of their workforce to military service, recovered by 1916 and were heavily engaged in producing metals, fuel and chemicals for military purposes. Mitchell worked closely with Urquhart as war progressed, particularly in mobilising the huge Irtysk project in Siberia. After the outbreak of the Russian revolution in March 1917, which occurred while Urquhart was working in Petrograd from May to August 1917 when he wrote long letters to Mitchell giving him business instructions and political commentaries. After the Bolshevik coup in November 1917, for eighteen months Urquhart's companies played a crucial role in the civil war by supplying the White Russian armies with war material. In April 1918, in cooperation with the British Department of Overseas Trade, Urquhart registered a company, the Siberian Supply Co., of which Mitchell was one of the directors. The company was to act as an agent of the British Government in Siberia, ostensibly to supply economic relief to the local population but, in reality, to supply the White Russian forces through Vladivostok where an office operated until 1920. In February 1919, Mitchell and a colleague went to Vladivostok to facilitate these operations. The White Russian cause which had its high tide in mid-1918 had been lost by early 1920. In November 1919 Urquhart formed a new company Russo-Asiatic Consolidated Ltd to take over all the Russian assets of the Urquhart group of companies. Urquhart began a long campaign seeking from the Soviet Government new mining concessions or compensation for nationalisation of the company's property. However, because of his 'interventionist' activities during the civil war these efforts never had

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much chance of success and were, in the end, fruitless. Urquhart also sought replacement mining ventures around the world but had limited success until 1927 when he succeeded in acquiring from W.H. Corbould (q.v.) a controlling interest in the huge Mount Isa mining project in Queensland. He visited Mount Isa in 1927 with Corbould and Mitchell and had successful negotiations with the Queensland Government. Another visit was made with Mitchell the following year to expedite the development of the Mount Isa mine and town. Urquhart had an extensive search for a partner to assist in the huge cost of developing Mount Isa. In 1929 he negotiated the involvement of Guggenheim's company ASARCO which eventually took over full control of the project and Mitchell was no longer associated with it. Urquhart died in 1932. Mitchell retained his holdings in Russo-Asiatic Consolidated and, when it was finally liquidated in October 1957, he was the last surviving director from the pre-World War 1 boards. The return to shareholders was a mere 0.3648 pence per share, a sad ending to a remarkable industrial empire from which, but for the Russian Revolution, its principal shareholders could well have made millions of pounds.

Nash 1 pp.60-61, 76, 349, 356-68, 441-42; Nash 2 pp.260-61, 273, 458; Kennedy pp.74, 101, 133, 241, 290; Birrell 7 pp.19-20, 28, 41-43; JCMWA 1907

### **MOFFIT, G.T.**

Moffit, an accountant by training, worked for Bewick Moreing & Co., mining consultants and mine managers, for over ten years at mines managed by the company. In 1909 he was posted to Vivien GMg Co. Ltd (EMGF), ten miles north of Lawlers, which operated from 1903 to 1914 to produce 76,795 fine oz of gold. From September 1911 to March 1913 he was at Oroya Black Range Ltd (EMGF Black Range) at Sandstone which operated from 1906 to 1914. In 1913 Moffit moved to another Black Range mine, Yuanmi GMs Ltd (EMGF) at Youanmi. The following year he was transferred to Great Fingall Consolidated Ltd (MGF Day Dawn) which Bewick Moreing had managed since 1899 and which to that date, 1914, had produced the largest quantity of gold of any mine in the state outside Kalgoorlie-Boulder. Moffit was appointed manager of the mine for 1919 and 1920. The mine closed in 1924 having produced a total of 1185 thousand fine oz of gold from 1866 tons of ore.

JCMWA 1909-1920

### **MONTGOMERY, Alexander** AOSM, MIMMAmer, MAusIMM. (1862-1933)

Born and educated in Scotland, Montgomery emigrated to New Zealand with his parents in 1865. He studied at Otago University and its School of Mines, and joined the New Zealand Public Works Department in 1885. He transferred to the Mines Department in the same year and subsequently became Principal of the Thames School of Mines. In 1889 he moved to Tasmania to become the Inspector of Mines and Geological Surveyor. He returned to New Zealand in 1896 to work as the superintending engineer of a freehold forest and mining estate. In 1902 he was appointed State Mining Engineer in Western Australia. He commenced work in November 1902 and continued in office for over a quarter of a century until his retirement in 1928. In addition to advising the Ministers for Mines he worked closely with the Under-Secretaries for Mines (the departmental head) and was the most powerful of the departmental branch heads. He was responsible for the inspection of mines for which there were seven inspectors, the location of whom varied according to local variations in mining activity. He was ex officio chairman of the advisory body of the School of Mines and strongly supported the Mines Department retaining its responsibility for the School rather than the Education Department becoming responsible. Montgomery was Chairman of the 1904 Royal Commission on the immigration of non-British labour and also of the 1905 Royal Commission on ventilation and sanitation of mines. He was responsible for the writing the reports on these two Commissions. In 1913 he was Special Commissioner to the Tasmanian Government to investigate and report on the fire

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at the Mount Lyell Mine. He gave evidence to a number of inquiries into the mining industry which included the Royal Commissions into Boulder Deep Levels assay sampling (1904) and into Great Boulder Perseverance Gold Mining Company (1904) and also the State Batteries Inquiry Board (1906). Also included were the Royal Commissions into pulmonary diseases amongst mines (1910) and on miners' lung diseases (1911) and three Royal Commissions into the Collie coal industry (1905, 1916 and 1933). He was a foundation member of the Australasian Institute of Mining Engineers, its president in 1895-96 and a member of its executive committee until 1900. His published papers include:

Presidential Address, 'Suggestions as to classification and description of Australasian useful mineral deposits', *TAusIME* 3, 1895, pp.7-19;

'The useful minerals of Tasmania', *TAusIME* 3, 1895, pp.203-30;

'Some geological considerations affecting Western Australian ore deposits', *TAusIME* 13, 1909, pp.160-83;

(with Gibb Maitland) *The geology and mineral industry of Western Australia*, WA Government, 1912;

'Earth movements and underground ...in mines', *JCMWA* 17, 1918, pp.119-27;

'Pulverised fuels', *JCMWA* 19, 1920, pp.50-58;

'The mining industry and mining resources of Western Australia' and 'Special legislation on safety and welfare of miners' in *Handbook and Review of Science*, ANZAS, 1926;

Departmental reports: 'Warren River oil fields', 1903; 'Phillips River goldfield', 1903; 'Kalgoorlie mines', 1908; 'Yilgarn goldfield', 1908; 'Iron deposits at Yampi Sound', 1924; 'Wilga coalfield', 1924; Annual reports of the State Mining Engineer from 1902-03 to 1928-29.

ArcAusMM; 'Obit' *ProcAusIME* 92, 1933; Spillman, pp.114, 139-46, 177; Gibney /Smith 2, p.114

**MOORE**, Dr. Bertie Harcourt DSc, ME, FSASM, FACI (1880-1946)

Born in New Zealand and educated at schools in London, Sydney and Melbourne, Moore graduated from the University of Adelaide with a BSc in geology and mechanics in 1901, and from the SA School of Mines with a fellowship in geology and mining in 1902. He was appointed a lecturer in metallurgy at the Western Australian School of Mines, Kalgoorlie, in 1908. The thesis he submitted in 1913 for the degree of Master of Engineering was entitled 'The results of experimental metallurgical research...at the School of Mines WA'. He was awarded the degree of DSc in 1931. Appointed officer-in-charge of the School's metallurgical laboratory in 1923, he played a significant role in introducing the flotation process for the recovery of gold from ores, assisted by metallurgists A.S. Winter and W.G Clarke (both q.v.). Moore gave evidence to the Royal Commission on Mining in 1925. He became Principal of the School of Mines in succession to J.F. Lynch (q.v.) in 1940, and Director in 1941 when Lynch retired. Moore retired in 1945 and was succeeded by R.W. Fletcher.

His published papers include:

'Recent improvements in metallurgical practice in Western Australia', *CEMR* May 1932, p.263;

'Progress in the metallurgy of gold', *CEMR* Oct 1933, pp.43-45;

'Revival of copper smelting in Western Australia', *CEMR* Sept 1945, pp.377-81;

'Development of flotation in Western Australia', *CEMR* Oct 1946, pp.11-14;

(papers with A.S. Winter): 'Application of the flotation process to gold ores', *CEMR* June 1925, pp.353-57;

'Laboratory flotation of Kalgoorlie ores', *CEMR* Sept 1926, pp.483-85;

'Treatment of low grade ores', ANZAS, Perth, 1926;

'Flotation of auriferous ores. Report on the investigation made at the pilot plant of Oroya Links Ltd on Croesus Pty gold-bearing ore, Kalgoorlie, W.A.', *CEMR* Oct 1926, pp.10-15;

(papers with W.G. Clarke): 'Flotation of antimonial ore from Wiluna', *CEMR* May 1930, pp.294-95;

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'Treatment of Lake View and Star low grade sulphide ore', *CEMR* June 1930, pp.324-26.

Thirty reports by Moore & A.S. Winter on the treatment of ores at the WASM's metallurgical laboratory were included in RDM 1926, pp.147-224.

RDM 1923, 1926, 1940, 1945; *WWA* 1944, p.60

**MOORE**, Hugh Lucius MAusIMM. (c.1878-1962)

Moore was born in Ireland where he qualified as a metallurgist at the College of Science in Dublin in 1899. He travelled to Western Australia in 1900 where he initially operated a cyanide works in Coolgardie and then worked at South Kalgurli GMs Ltd (ECGF Boulder). In 1905 he was at Corona Consolidated Co. (MGF), at Nannine, which was developing the leases formerly held by the Nannine Consolidated GMs Ltd and Australian Champion Reef Co. Ltd. In 1907 he was at Lancefield GMG Co. Ltd (MMGF) at Laverton where refractory sulphides were proving difficult to treat satisfactorily. The following year he joined Ida H. GMG Co. Ltd (MMGF), also at Laverton. He worked initially on the battery and cyanide plants, and later became the mine's metallurgist and surveyor. The mine had started full production in 1902 and during the remaining 1900s it had an average annual production of 10 thousand fine oz and paid dividends each year. Moore was at the mine almost ten years leaving when the mine approached its closure (which came in 1920). In 1918 he was the surveyor at Kalgurli GMs Ltd, shortly before it ceased its independent existence in 1920. In that year Moore was the manager of a phosphate mine on Walpole Island off New Caledonia. Returning to Western Australia he spent two years as manager of Forwood Downs Ltd., the mechanical engineering manufacturer in Kalgoorlie, before joining the staff of Great Boulder Proprietary GMs Ltd in 1926. Towards the end of the 1930s he became the manager of several small mining companies including First Hit GM Co.(NCGF) near Davyhurst. He was elected a member of the Australasian Institute of Mining and Metallurgy in 1933.

Colless p.148; *CMWA* 1938, 1942; *MYBA* 1940, p.162; *DWAE* 5, p.634. *ArcAusMM*

**MOORE**, Karl Byron MAusIME. (b.1883)

After studying at the Ballarat School of Mines, Moore worked for two years on the Western Australian goldfields as an assayer and metallurgist. In 1908 he was employed by Bewick Moreing and Co., consultants and mine managers, as metallurgist at Oroya Black Range Ltd (EMGF Black Range) at Sandstone. The company had been floated by the Kalgoorlie mining company, Oroya Brownhill Co. Ltd, after Herbert Hoover, a partner in Bewick Moreing, had inspected the prospect and recommended its purchase. In 1909-10 the main ore shoot at the mine was found to peter out at depth. In 1911 Oroya Exploration Co., which had taken over the exploration assets of Oroya Brownhill, joined with Oroya Black Range to jointly floated Yuanmi Gold Mines Ltd (EMGF Black Range), a prospect at Youanmi, 100 km south of Sandstone. Later in 1911, Oroya Black Range was sold to Yuanmi Gold Mines. Moore remained at Oroya Black Range until it closed in 1914, when he transferred to Yuanmi Gold Mines. The new mine paid modest dividends in 1913 and 1914 but, in 1912, arsenic and antimony were 'unexpectedly discovered' in the sulphide ores at the mine. Moore and the chemist at the mine, H.R. Edmands (q.v.), devised a satisfactory sulphide treatment process, a paper on which was published as: 'Treatment of arsenical-antimonial sulphide ore at Youanmi' (*JCMWA* 14, 1915, pp.12-17). Moore and Edmands also sought a more effective means of precipitating gold in the cyanide process. In 1915 they invented an alternative method in which zinc dust was held by suction on the outside of a modified vacuum filter through which the gold solution was drawn, precipitating the gold. The unit which they called the Moore-Edmands extractor partly anticipated the Merrill-Crowe precipitator which required the de-aeration of the gold solution and which became an industrial standard in the 1920s. Moore and Edmands

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did not realise the significance of excluding air from the precipitation process but the two processes were otherwise almost identical. Moore was at Yuanmi Gold Mines until 1916 when he left to join the AIF. On his return from service he was employed by Electrolytic Zinc at Risdon in Tasmania from 1921 until leaving to work in Rhodesia. He returned to Australia in the 1930s. He was elected a member of the Australasian Institute of Mining Engineers in 1913.

CMWA 1912, 1917; Hooper p.86; ArcAusMM; Nash1 pp.375-403

### **MORGAN, Frederick W.** (1866-1913)

Born in Auckland, New Zealand, Morgan worked as a miner and then as an underground foreman at the Broken Hill Proprietary mine. He came to the Western Australian Eastern Goldfields as a prospector and investigator of mining prospects. He was manager of Lake View Consols Ltd (ECGF Boulder) in the late 1890s. In January 1902 he inspected Merton's Reward (MMGF Mertondale) with C. Kaufman (q.v.) and R. Hamilton (q.v.) after which Kaufman purchased the mine and floated Merton's Reward GM Co. Ltd. Morgan was appointed manager but resigned in February 1903. In 1905-09 he was manager of the Phillips River Gold and Copper Company (PRGF) at Ravensthorpe. The company's plant consisted of a copper smelter which had originally been built by the government together with a number of mines which supplied ore for the smelter. The company was under the general management of G.C.Klug (q.v.), until 1908 when he resigned after a disagreement with one of the company's directors. To investigate ways of improving the separation of copper and gold, samples of ore were sent for testing at the Melbourne testing facilities of Minerals Separation Ltd. The tests were to determine whether the ore was suitable for processing by Minerals Separation's flotation plant. It was found that flotation could be usefully used to separate the minerals. However, the process was not adopted by the Phillips River Co., possibly because the company could not raise the necessary capital. Morgan resigned from the company in 1909 and was the general manager of Bull Ant Proprietary Co.(YGF) from 1911 until his death.

WAMBEJ 28 Feb 1903 p.5, 22 May 1909 p.5, 4 Oct 1913 p.6; Skinner 1903, 1909; JCMWA 1908, 1911; Birrell, *Monog. No. 7, Flotation*, 2000, pp.26-28; Reid pp.263,268, 286

### **MORGAN, John MIMM.** (c.1864-1934)

Morgan worked in the Queensland mining industry for fifteen years before moving to Western Australia where initially he managed a mine at Norseman (DGF). He joined Bewick Moreing & Co., mine managers and consultants, in 1904 and spent a year as the first Bewick Moreing manager of Burbanks Birthday Gift GM (CGF Burbanks). He then managed South Kalgurli GMs (ECGF Boulder) in 1905-07, Oroya Brownhill Co. Ltd in 1908-09, and South Kalgurli again in 1910-13. These short postings during the 1900s which were arranged by Herbert Hoover, a Bewick Moreing partner, were typical of the company's operations during that decade and were intended to encourage competition between managers and to remove the non-performers. Morgan visited Wales in 1912, and worked mainly in London from 1915 onwards. He was consulting engineer for North Kalgurli Co. Ltd. (ECGF Kalgoorlie) in 1913, and for South Kalgurli Consolidated Ltd between 1915 and 1920, after South Kalgurli had amalgamated with Hainault GMs Ltd. Morgan gave evidence to the Royal Commission on ventilation and sanitation of mines in 1905. He became a member of the executive council of the WA Chamber of Mines in 1908, and was elected a member of the Institution of Mining and Metallurgy in 1913.

JCMWA 1905, 1913, 1920, 1932; WAMBEJ 4 Jul 1914, p.13; Skinner 1905, 1915, 1920; TIMM 44, 1934, p.518



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**MORGANS**, Alfred Edwards MLA.

(1850-1933)

Morgans was born in Monmouthshire (now Gwent), and after an education at private schools and a school of mines, he served an apprenticeship with a mechanical engineering company in Ebbw Vale, working subsequently in various parts of Britain on iron and coal mining projects. In 1878 he went to Mexico to supervise the erection and commissioning of mining equipment and afterwards represented British investment in mining and railways in Central America, notably in Guatemala and Nicaragua. After his return to Britain, on behalf of mining consultants, Bewick Moreing & Co., in 1895 he attended tests in Hamburg, carried out by the German company Pape Hanneberg & Co., on oxidised ore from Hannan's Brownhill GM Co (ECCF, Kalgoorlie) to determine potential treatment methods. During these tests, filter presses were used for the first time in gold ore processing to hold slimes of finely crushed ore while gold was removed from them. (q.v. Diehl). In the following year, 1896, Morgans travelled to Western Australia to represent an investment group, Morgans' Syndicate Ltd, which was seeking suitable mining properties in which to invest. Soon after his arrival in Kalgoorlie Morgans inspected for Bewick Moreing an oxidised ore processing plant at Hannan's Brownhill's mine, which was managed by Bewick Moreing. Because of the paucity of water in Kalgoorlie the plant had been designed as a dry crushing plant but was operating ineffectively. Morgans' report was very critical of both its design and operation. In August 1896, he acquired, for the Morgans' Syndicate, Burbanks Grand Junction Ltd (CGF Burbanks) which was worked until 1901 for 2136 fine oz. In June 1898 he supervised the recommencement of operations at Hannan's Croesus mine (ECGF Kalgoorlie) which had been idle for three years.

In 1896 Morgans inspected mining properties in an area 15 km north of Mt Margaret township (MMGF) and Lake Carey where he purchased leases covering 48 acres on an extensive north-south outcropping lode. The mine was named Westralia Mt Morgans and the associated township became Mt Morgans. Morgans formed a limited liability company for the mine in Perth in 1897. Subsequently, in 1900, the mine was registered in London as Westralia Mt Morgans GMs Co Ltd with Morgans as its Australian managing director. The mine became operational in 1898 with Morgans' son, M. Percy Morgans (q.v.), as its manager. As workings extended, a 20 head stamper was installed in 1899 and 60 head were operating in 1903 when the mine reached its peak annual production of 54,000 fine ounces. This was the tenth largest for a Western Australian mine in that year and the third largest for a mine outside Kalgoorlie. By then the company had taken over two smaller neighbouring mines, Lily of the Valley GM and Guest's GM Ltd. In May 1900 Morgans registered in London another Mt Morgans mine, the Millionaire Ltd, for which he was the managing director in Australia and his son its attorney and later also its manager. It operated until 1911 and produced 6.6 thousand fine oz. Westralia Mt Morgans paid five annual dividends from 1900 to 1904 which totaled £226 thousand (the mine's nominal capital being £125 thousand). Its production may have been forced as production halved two years after its peak. The mine closed in 1911.

In addition to his mining activities Morgans was very active in public affairs. In 1897 he was elected MLA for Coolgardie and easily retained his seat in 1901 despite his opposition to federation and his capitalist views. In his official speeches he was a strong supporter of goldfields railways and public works. In August 1897 he was appointed a member of the Royal Commission on Mining in Western Australia and in October 1898 to the Select Committee considering the Regulations under the 1895 Goldfields Act. The reports of these committees eventually culminated in the enactment of the 1904 Mining Act which replaced the previous mining legislation. Morgans was President of the 1899 Coolgardie International Exhibition and on 21 March welcomed the official guests arriving by train for its opening. He was mayor of the City of Coolgardie in 1898 and served on the North Fremantle Municipal Council between 1918 and 1920. He was the first president of the Coolgardie Chamber of Mines and Commerce which combined with the Kalgoorlie Chamber of Mines in 1901 to form the Western Australian Chamber of Mines of which he was a vice-president. In Parliament he was an

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independent but usually voted with the Forrest government. In the period of instability following Forrest's entry into Federal politics, Morgans became Premier and Colonial Treasurer for 32 days from 21 November 1901. He was defeated when three of his ministers failed to be endorsed by the Assembly, several of his supporters defected and the Governor refused a dissolution. He retired from politics at the next election in 1904.

In 1898 Morgans travelled to the Pilbara (containing the West Pilbara GF around Roebourne and the Pilbara GF around Marble Bar and Nullagine) to inspect likely mining properties for possible purchase. He visited groups of gold mines in the vicinity of Marble Bar, Warrawoona (22 km south-east of Marble Bar), and Nullagine and also Croydon copper mine, 40 km from the small port of Balla Balla, tin deposits near Marble Bar and a conglomerate deposit at Nullagine where the first diamonds in the state had been found in 1897. Morgans purchased leases covering these areas. In October 1900 he sailed for London where he launched a new company, British Exploration of Australasia Co. Ltd of which he was managing director and which purchased his Pilbara leases. No effective work seems to have been done on the Croydon copper mine or the tin leases and the diamond deposits were found to be uneconomic to work but three of the gold mines were worked by Morgans from 1898 until 1902 and by British Exploration from 1902 until 1909 or 1910. At Warrawoona two productive mines, Gauntlet and Bow Bells, produced 4086 ounces for Morgans at a useful grade of 2.3 oz per ton but at the same locations British Exploration later only produced 1191 oz at 16 dwt per ton. Production records for the other two mines at Nullagine and Lalla Rookh (70km from Port Hedland) are clearly defective. At Nullagine only two ounces were recorded for the pre-1898 prospector who was known to have purchased a pastoral property in the Mid-west with the proceeds from the mine. At Lalla Rookh the only gold recorded was 2,079 oz obtained by the company from the cyaniding of tailings. The main difficulty for company mines in the north-west was the lack of adequate transport, particularly a railway. Morgans lobbied strongly for a railway from Nullagine and Marble Bar to Port Hedland and one was planned in 1908. The length from Marble Bar to Port Hedland was eventually built in 1912 but by then British Exploration had been liquidated.

From 1899 Morgans also took an interest in the mining potential of the Ravensthorpe region (PRGF). He took options on several mines and in 1900 purchased the 'Floater' mine. In January 1901 he launched the Gilbert GM Ltd in London to take up a quarter interest in the Floater, Morgans retaining the other three quarters. The mine produced 10,661 fine ounces in the three years to 1905 when it ceased operating. Morgans went to London in 1909 to raise more finance for the mine but was unsuccessful. He also owned the 'Famous Blue' mine at Duketon (MMGF) which in four years to 1908 produced 4,695 fine oz. In 1913 he was a director of Greenbushes Development Company and of Estano Sluicing which worked tin at Greenbushes.

He was the state consul for Austria-Hungary in 1910-17, vice-consul for Spain in 1915, consular agent for the United States in 1921-30 (having been acting agent from 1918). He was a member of the faculty of engineering at the University of Western Australia in 1929. He had houses in Perth, Coolgardie and Albany and a grazing property in the Porongorups on which he grazed fallow deer. He was president of the acclimatisation committee which administered the Perth Zoological Gardens in 1921-29. He died at South Perth in 1933.

*WArg* 2 Aug 1900; *JCMWA* 1902, 1910; Skinner 1904, 1906, 1909; *FJA* 1914 p.147; *WAMBEJ* 4 Jul 1914 p.11; *WWA* 1922 p.198; Black/Bolton 1, p.145; *ADB* 10, p.586. M.K. Quartermaine, pers. com. 1990; de Havelland 1, pp.76-89; Chase/Krantz pp.7-9; Reid pp.216, 225, 235, 243, 257; Thiel pp. 228-35, 307, 333

### **MORGANS, Morgan Percy**

Percy Morgans, the son of A.E. Morgans (q.v. above), was born in Bristol, England, and as a young boy lived for a time in Guatemala in Central America where his father was stationed. He returned to Britain to complete his education at Monmouth Grammar School. He returned to Central America to work in the mining industry for six years before coming

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back to England to work in Cornish mining until 1893. To gain further practical experience he trained as a fitter before travelling to Western Australia at the same time as his father. He worked in the Mount Margaret GF until his father had established Westralia Mt Morgans GMs Co of which he was appointed manager in 1898, initially under the Perth-registered company and then under the London company. The mine was initially successful reaching its peak annual production of 54,000 fine oz in 1903 and paying dividends in the five years from 1900 to 1904 of nearly twice its nominal capital. However in 1905 production dropped by 50 per cent and the mine closed in 1911. In 1900 A.E. Morgans floated in London another Mt Morgans mine, Millionaire Ltd. Percy Morgans was its attorney and in 1904 became its manager. The Millionaire was less successful than the Westralia and also closed in 1911, having produced only 6,576 fine oz. Percy Morgans pre-deceased his father.

*JCMWA* 1903, 1905; Thiel p.333; Skinner 1903, 1904, 1906

### **MORRIS, M.W.**

Morris was a mining technologist employed by Bewick Moreing & Co. during the 1900s on mines which the company managed. In 1902 he was at Hannan's Brown Hill GMG Co. Ltd (ECGF Kalgoorlie) and, after the company amalgamated with Hannan's Oroya GMG Co. Ltd (ECGF Boulder) he joined the new company Oroya Brownhill Co. Ltd (ECGF Boulder-Kalgoorlie). He was at the mine until the end of 1905 and represented it on the Chamber of Mines of WA. In 1905 the mine reached its peak annual production of 155 thousand fine oz which was the third highest in the state that year. In 1906 and 1907 he was manager of Boulder Deep Levels Ltd (ECGF Boulder) at the south-eastern end of the Golden Mile which was a low producer and was reconstructed in 1907. In 1908 and 1909 Morris was manager of White Feather Main Reefs (1906) Ltd (NECGF Kanowna). The mine had been Kanowna's largest producer (12 thousand fine oz in 1902) but after 1902 production fell rapidly. In 1904 Bewick Moreing was called in to take over management and raise production but was unsuccessful. Morris suspended crushings in 1909 and the mine was opened to tributers.

*JCMWA* 1902-1909; RH.Kalg tb 4

### **MOSS, Edward** (b.c.1859)

Edward Moss was the eldest of the three Moss brothers who came from Mount Barker in South Australia. From 1893 to 1895 he and the second brother, Frank (q.v.), prospected in the Coolgardie and Menzies areas. They found two promising prospects at Comet Vale near Menzies which they sold. From 1902 Edward joined Frank at Kalgoorlie Gold Recovery Company Ltd. which was claimed to be the largest privately owned plant for the treatment of custom ore on the Goldfields. Edward represented it in the Chamber of Mines in 1903-05. From 1905 to 1907 he was manager of a mine at Kanowna (NECGF) operated by London and Coolgardie Explorers Ltd which was in the process of closing down. In 1910 he joined his brothers Frank and Herbert (q.v.) at Sand Queen GMs Ltd (NCGF) at Comet Vale which was a mine partly developed from one of the prospects sold by Frank and Edward in 1895. They worked the mine successfully until 1920. Edward represented it on the Chamber of Mines in 1916-20.

*JCMWA* 1902, 1903, 1917, 1920

### **MOSS, Francis (Frank) Ambrose** ABalSM, MAusIMM, FCS. (1862-1940)

Born at Mount Barker in South Australia and educated at Whinham College, Moss graduated from Ballarat School of Mines in 1889, and became an assayer at Broken Hill. He worked at Broken Hill Proprietary's silver/lead smelter at Port Pirie shortly after its opening and then underground in its Broken Hill mine. He arrived in Albany in 1893 and prospected in the Coolgardie and Menzies areas with his brother Edward. They found two promising prospects at Comet Vale (NCGF) near

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Menzies which they sold. In 1896 he was in business in Menzies as a mining engineer, assayer and mining property manager. Leaving Menzies, he was appointed representative for Broken Hill Proprietary Co. Ltd in Western Australia and in 1897 and 1898 he was responsible for the purchasing of high grade ore for the company. In 1900 he was appointed deputy manager of Kalgurli GMs Ltd under Robert Black (q.v.). Moss was responsible for developing the treatment process for Kalgurli's sulpho-telluride ore which was to be based on the 'dry crush and roast' process which had first been devised by John Marriner (q.v.) at Great Boulder Main Reef. In 1902, Robert Black resigned as manager of Kalgurli GMs Ltd, and also of Hainault GM Ltd, due to ill health. Moss was appointed to both positions.

The American Ropp reverberating furnace had been chosen as the roaster for Kalgurli's sulphide plant, despite the furnace's unsatisfactory performance at the Associated mine. However, Moss devised a unique process to overcome the main failings of the roaster by cyaniding the roasted ore in three streams instead of the two used by Marriner. A concentrate was removed from the sands fraction of the roasted ore. The remaining sands were percolated with cyanide, while the concentrate was ground to slimes, agitated with cyanide and filter pressed. The slimes fraction of the roasted ore was separately agitated with cyanide and filter pressed. Although the additional stage in the process made it more expensive than the standard 'dry crush and roast' process, Moss's process achieved the best extraction rate by far of any of the first generation of Kalgoorlie dry crushing sulphide plants. However, when the Edwards roaster from Victoria proved to be the most effective on sulpho-telluride ores, Moss replaced the Ropp roasters with Edwards ones and also adopted the standard Marriner treatment process.

In 1905 he served as consulting engineer for Golden Ridge and helped the company to overcome a poor start and to bring it into profitable operation. With his brother Edward as partner, in 1902, he established the Kalgoorlie Gold Recovery Company which was claimed to be the largest privately owned plant for the treatment of custom ore on the Goldfields. He managed the company until 1907. When Black had recovered from his illness, in 1907, and was able to return to his former positions, Moss resigned as manager of the Kalgurli and Hainault mines. In 1907 he formed the company Westralia Gully Tin Ltd to mine alluvial tin at Greenbushes. He erected what was thought to be the first tin dredging plant to be used in Western Australia. The Westralia Gully company worked in 1908 and 1909 before being liquidated. However, Moss launched another dredging company, Greenbushes Tin Ltd, which in 1910 had two dredges working the deposits. The company continued in operation until 1924. In 1910 Moss acquired Sand Queen GMs Ltd (NCGF) at Comet Vale, a company which had been formed to mine one of the prospects which he and Edward Moss had sold in 1895. The three brothers erected a treatment plant at the mine (probably from Kalgoorlie Gold Recovery Co.) and worked it until 1920, producing 102 thousand oz of fine gold from 116 k ton of ore. In 1915, R. Hamilton, G. Ridgway (qq.v) and Moss formed a syndicate to purchase the Lancefield gold mine (MMGF), five miles north of Laverton and floated Lancefield GM (1915) Co Ltd. This mine had been formed by Bewick Moreing in 1904 but the removal of arsenic in the sulphide ore had proved more expensive than anticipated and the mine had been abandoned. The syndicate successfully adopted the Kalgoorlie 'dry crush and roast' treatment method to process the mine's refractory arsenopyrite ore. The mine, managed by Moss, operated until 1921 when it closed because of rising costs, having paid £128,000 in dividends. In 1932, Moss was working as a mining engineering consultant in Perth.

Moss was a founding member of the Australasian Institute of Mining Engineers in 1893 and was president of the Institute in 1901. His chairman's address was published as 'The treatment of auriferous sulphide ores of Kalgoorlie' (*TAusIME* 8-1, 1901, pp.40-67). He gave evidence to the Royal Commissions into the Great Boulder Perseverance Mine (1904) and into ventilation and sanitation of mines (1905), and in 1906 to the Commonwealth enquiry into the effects of customs duties. In 1904 he applied for a Western Australian patent with W.W. Barton (q.v.) for 'the use of chemicals to destroy fumes from

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explosives' and in 1906 he registered Commonwealth Patent 5739 for 'improvements relating to filter presses' which he renewed in 1913. He was a Trustee of the Perth Public Library, Museum and Art Gallery.

WAGC 18 Jul 1896 p.24; KM 11 Nov 1898, 31 Jul 1940; JCMWA 1903, 1904; RH.Kalg ch 4.3; Skinner 1903, 1904; RDM 1910 p.47; 1914 p.51; John's p.125. 'Obit' *ProcAusIMM* 119, 1940 (2); ArcAusMM; Reid pp.62-63; Patent Register of W.G. Manners

**MOSS**, Herbert William ABalSM, MAusIME. (b.1869)

The third of three Moss brothers (above), Herbert was a graduate of the Ballarat School of Mines. He worked for Broken Hill Proprietary at its Port Pirie silver/lead smelter in 1894-95. In 1902 he joined his brother, Frank, at Kalgurli Gold Recovery Company which was claimed to be the largest privately owned plant for the treatment of custom ores on the Goldfields. He represented the company on the Chamber of Mines in 1907-11. In 1901 he was elected an associate member of the Australasian Institute of Mining Engineers, and was elevated to membership in 1908. He was at the Sand Queen GMs Ltd. (NCGF) at Comet Vale between 1912 and 1920 when the company paid dividends totalling £112,500.

Skinner 1915, 1920; WAMBEJ 30 Sept 1905 p.6; JCMWA 1908; 1913; 1920. ArcAusMM.

**MUNDLE**, Edward Barker AWASM, MAusIMM, MIMS. (1893-1966)

Mundle was an assistant in the assay office of Kalgurli GMs Ltd (ECGF Boulder) in 1909, and was an engineering cadet in the Goldfields Water Supply branch of the Public Works Department in 1912. He became an assistant in the survey office of the Ivanhoe Gold Corporation Ltd (ECGF Boulder) in 1914 and in its assay office in 1915. Later in the year he was working as a draughtsman in the office of John Darbyshire, supervising engineer of the Western Division of the Transcontinental Railway from Kalgoorlie to Port Augusta during its construction. He obtained his mine surveyor's certificate from the Western Australian School of Mines in 1915 and from 1916 to 1919 he was in the AIF on active service. After the war he returned to Kalgoorlie to work for South Kalgurli Consolidated Ltd (ECGF Bolder) as a mining surveyor. He completed his studies at the School of Mines in 1930 and was awarded a diploma in mining and a geologist's certificate. He was employed as underground manager at Croesus Pty Ltd (ECGF Kalgoorlie) in 1929. This mine, on a single lease, had been part of Oroya Links Ltd but, when Oroya Links ceased production in 1920, the Croesus Pty lease which contained Oroya Links's treatment plant, was acquired by South Kalgurli although the lease was separated from the original South Kalgurli lease by other companies' leases. The Oroya plant was then used to treat ore from both South Kalgurli and North Kalgurli (1912). In 1934 Mundle was underground manager for the mining of both South Kalgurli leases. He moved to Wiluna in 1939 to become manager of the Moonlight Wiluna GM (EMGF Wiluna). This mine in 1938 produced 36 thousand fine ounces of gold which was the eighth highest total produced in that year by any Western Australian mine. Between 1940 and 1961 he was general manager of Goldfields Australian Development Company in Kalgoorlie. Mundle was elected a member of the Australasian Institute of Mining and Metallurgy in 1933 and was a member of the executive council of the WA Chamber of Mines from 1946 to 1963.

RDM 1915 p.146; CMWA 1920, 1940, 1963; R Met Lab Kal 99 June 1937, 277 Sept 1944; MYBA 1951, 1959

**MURRAY**, George Daly MAusIMM. (b.c.1863)

Murray worked in the Victorian and Tasmanian mining industry for four years until circa 1891 when he moved to Western Australia where, in 1894, he was employed in the treatment plant of Hannan's Brownhill GMg Co. Ltd. (ECGF Kalgoorlie) and, in 1895, as mill foreman in the treatment plant of Oroya Brownhill Co. Ltd. (ECGF Boulder). He was appointed metallurgist at the Ivanhoe Gold Corporation Ltd (ECGF Boulder) in 1903 and worked at the Ivanhoe mine until it closed in 1924. He was elected a member of the Australasian Institute of Mining Engineers in 1909.

JCMWA 1909, 1920; ArcAusMM

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**MURRAY**, Virginius Henry Randolph MAusIMM, MIMM, MIMSWA. (1872-1937)

Born in Ballarat, Murray, whose father was the Victorian Government geologist, worked as a surveyor with the Victorian Water Supply Commission, and then, in 1893, with the Broken Hill Proprietary Co. He was employed as a mining surveyor by Lake View Consols Ltd (ECGF Boulder) in 1897, by Golden Horseshoe Estates Co. Ltd. (ECGF Boulder) in 1899 and by the Ivanhoe South Extended GMg Estates Co. Ltd (ECGF Boulder) between 1904 and 1909. He returned to Golden Horseshoe Estates as surveyor in 1910 and became its underground manager in 1919. He retired in 1925. He was elected a member of the Australasian Institute of Mining Engineers in 1909. He was a licenced surveyor under the Transfer of Land Act and also a certified mine surveyor. He was president of the Institute of Mining Surveyors (Western Australia) for twenty-one years. His published writings include 'An underground survey' *JCMWA* 1913, pp.211-15.

*JCMWA* 1904, 1910, 1920; Skinner 1909; *TIMM* 47, 1937, p.545; *ArcAusMM*; M.K. Quartermaine, pers. comm. 1991

## N

**NEWMAN**, Henry Burge AWASM, MAusIMM, MIMS (1895-1984)

Born and educated in Victoria, Newman started work with South Kalgurli GMs (ECGF Boulder) in 1910. He enlisted in the AIF and served in France between 1915 and 1919. An electrician by trade, he studied at the WA School of Mines to obtain a mine surveyor's certificate in 1933 and a diploma in mining in 1936. He became chief surveyor of South Kalgurli Consolidated GMs and its underground manager under F. Brindsen (q.v.). Newman was general manager of South Kalgurli from 1947 until its amalgamation with Gold Mines of Kalgoorlie in 1955, and then manager of the latter until production ceased in 1963. He continued to be a consultant to the company for several years. He was an active member of the Institute of Mining Surveyors (WA), and was elected an associate member of the Australasian Institute of Mining and Metallurgy in 1933 and a member in 1942. He retired to Mandurah.

*CMWA* 1951, 1961; *IRMYBA* 1955; M.K. Quartermaine, pers. comm. 1991

**NICHOLAS**, Askin

Nicholas was manager of the Queen Margaret GM (ECGF) at Bulong in 1898 when he invented a rotary vacuum filter which was the first vacuum (or suction) filter to be used successfully on any goldfield in the world for cyaniding gold-bearing slimes. In the standard method of using filter-presses, which was perfected in Kalgoorlie during the early 1900s, a series of square filters (about 1m square) were placed in a press and the treated slimes were forced onto the filters. Water was then passed through the filters which dissolved out the gold solution which was collected and treated to remove the gold. The movable drum filter of Nicholas consisted of a large cylinder approximately 3 metres in diameter and about 1m wide with filter cloth attached to its pervious circumference. The drum was rotated continuously about its horizontal axis so that at the lowest point of its rotation a third of its circumference was immersed in a tank of cyanide-treated pulp. A layer of pulp was sucked onto the filter cloth on the drum. The drum rotation brought the pulp on its circumference towards its highest point where water was sprayed through the pulp collecting the gold solution inside the drum which was piped away for treatment. The exhausted pulp on the drum moved downwards past its high point and was removed by compressed air and a cutting edge to fall into a waste container for removal. Nicholas obtained an American patent for his invention in February 1899 and also WA patent no.3209 for it in September 1898. In 1899 he became manager of Peak Hill Goldfield

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Ltd. (PHGF) at Peak Hill which was one of the most productive goldmines in the northern goldfields despite its remote location. At the Peak Hill mine Nicholas built a production model of the rotary vacuum filter and it was successfully installed in the mine's production line (the Bulong one having been an experimental model). In between 1899 and 1902, when Nicholas left Peak Hill, the mine produced 111 thousand ounces of bullion from 160 thousand tons of ore. The mine's peak annual production of 31 thousand oz of fine gold in 1902 was the fourth highest total for any mine outside Kalgoorlie in that year. In 1907 an inventor in the USA applied for a US patent for a rotary vacuum filter which was identical in principle to Nicholas's and mechanically similar. Nicholas wrote to the American mining press protesting that his patent had been infringed but he could not afford to pursue the matter in the American courts. The American version, the Oliver vacuum filter, went into production and during the 1930s an improved version became one of the standard items adopted in treatment plant improvements in Kalgoorlie. Nicholas left Western Australia in c.1903 and in 1908 he was at a mine at Talmalmo in New South Wales. In 1909 he was in Cairns, Queensland, and in 1911 at Tongio West in Victoria. He was an associate member of the Chamber of Mines of Western Australia until 1920

*WAArg* 16 Feb 1899, 1 Mar 1900; *Skinner* 1900; *GG* 1901 p.1045; *JCMWA* 1902-20; *RH. Kalg.* cp. 6.2, tb 4; *M&SP* 1 Feb 1908

### **NICHOLAS**, Frank George Turner

Nicholas, an English mining engineer, was the administrative officer in the Coolgardie (later Kalgoorlie) office of Bewick Moreing & Co., mining consultant and mine manager, for fifteen years during the height of the gold boom. He joined the company in 1895 to work under Edward Hooper who was then the company's resident partner in Western Australia. The company was, to start with, principally occupied with locating promising mines being opened up by prospectors which could be profitably developed by public companies. The company employed a number of inspecting engineers to inspect and report on prospects which very often involved traveling long distances. Between January 1895 and 1900 these engineers produced 276 reports on different prospects, although only a small number were recommended by Hooper to the London head-office. Those approved were purchased by the firm's agency company and the London office formed a public company which purchased the mine and lease. Between 1894 and 1900 the firm floated 39 separate Western Australian mining, or mining associated, companies. Before 1897 each new company was an independent entity with Bewick Moreing acting only as its consulting engineer, but long distance management of outback mines by London businessmen resulted in considerable inefficiencies and heavy losses. From then on the mines of new companies formed by Bewick Moreing were usually managed by the company. In 1897 Bewick Moreing's Coolgardie office had a technical staff of ten. Five years later the company managed fifteen mines in WA and to cope with the complications of mine management the numbers in the Coolgardie office had trebled and each mine had a staff of over ten, each of whom was likely to be moved to whichever Bewick Moreing-managed mine needed his skills most. In 1901 the Western Australian Chamber of Mines was formed by combining the Kalgoorlie and Coolgardie Chambers. Its aims were to make a more professional industry, to act as a political lobby group and to represent its members in the hearings of the newly formed Arbitration and Conciliation Board which set wage rates at mines. All company mines had representatives on the Chamber, usually the mine manager and possibly another staff member. Some of the Bewick Moreing managed mines were considerable distances from Coolgardie which made it difficult to send representatives to the monthly meetings. In such cases they were represented on the Chamber by Nicholas, although he usually only represented one mine at any one time. These included Great Fingall Consolidated at Day Dawn (1901), Bellevue Consolidated Ltd at Sir Samuel (1903-1904) and Cosmopolitan Pty Ltd at Kookynie (1904-1906). Where there was a lengthy gap between managers of a mine he represented the mine on the Chamber (Sons of Gwalia at Leonora in 1906 and Cosmopolitan in 1909). He was the temporary manager of Bewick Moreing's

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agency/exploration company, London & WA Exploration Co. Ltd. in 1905, a year in which which inspecting engineers reported on 32 inspection tours. In 1905 he also represented on the Chamber Boulder Deep Levels Ltd the management of which Bewick Moreing had taken over that year. From 1903 Nicholas served on two of the four committees of the Chamber and from February 1906 served on the Executive Council of the Chamber. From February 1907 he was absent for eighteen months in Victoria and was probably working on two of Bewick Moreing's projects at Broken Hill and near Bendigo, Victoria, which were both at critical stages. Nicholas returned to Kalgoorlie and was on the Chamber's Executive Council again from February 1909 to June 1912 and also on three of its committees. From June 1909 to June 1910 he represented Oroya Brownhill Co. Ltd (ECGF Boulder) on the Chamber during the period when it amalgamated with two other mines to form Oroya Links Ltd. In 1911-12 he represented Lake View Consols Ltd (ECGF Boulder) at a time when the financial and exploration divisions of the company amalgamated with Oroya Exploration Co to form Lake View and Oroya Exploration and Finance. Nicholas left Kalgoorlie in December 1912.

WAMBEJ 26 Jan 1907, p.6; JCMWA 1902-1911; DMP Bewick Moreing report collection; RH.BMC

### NICHOLAS, William

Nicholas received his education and technical training in England before emigrating to Victoria. He was employed as a Government mining inspector in 1881 when he joined the staff of the Bendigo School of Mines which was still in its early years having held its first classes in 1873. Nicholas was employed as the lecturer in geology and mineralogy but his appointment was short-lived. In October 1881\* he applied for a salary increase and when this was refused he resigned. In the same year a vacancy appeared for a lecturer in mining in Melbourne University's Faculty of Engineering for which Nicholas successfully applied. He held the post until 1893 or 1894 when he resigned and moved to Western Australia where he was almost universally known as Professor Nicholas. Presumably he was not entitled to use the title 'Professor' but, on the goldfields, where most people had nick-names, probably no-one seriously questioned its validity. Between 1894 and 1902 Nicholas was the manager of Burbanks Birthday Gift GMs Ltd (CGF Burbanks) and Burbanks Main Lode Ltd (also at Burbanks) and was the engineering consultant for both. During this period, in 1902, Burbank's Birthday Gift, reached its peak annual production of 30 thousand bullion ounces which was the sixteenth highest recorded in the state that year. In 1902 a larger percentage of higher producers were mines outside Kalgoorlie than those five or ten years later. In 1902 ten mines outside Kalgoorlie produced more than 20 thousand bullion ounces (or its approximate equivalent, 15 thousand fine oz) whereas, in 1907, only six mines outside Kalgoorlie reached that figure.

In 1899 Nicholas was manager of Associated Australasian Miners Ltd and of Brother Jonathon Syndicate (BAGF Broad Arrow). He prepared a report on the Londonderry GMs Ltd (CGF Londonderry) in 1894, before Lord Fingall officially opened the mine, and another, in 1895, after the 'glory hole' was found to be virtually empty. He was attorney for Burbanks North GM Ltd, and Burbanks Consols Ltd in 1897 (both CGF Burbanks), for Gladiators Ltd (BAGF Broad Arrow) in 1899 and for Perseverance GMs Ltd (MMGF Webster's Find) in 1903-4. He appears to have returned to the eastern states by 1904 when he was at the Maryborough Leviathan mine in Victoria, although he was still the consulting engineer for the Burbanks mines in 1909 and their general manager between 1915 and 1920.

His publications include *'The Coolgardie Goldfield'*, Melbourne, 1895.

WAGC 25 Jul 1896, p.20; Skinner 1897, 1900, 1904, 1905, 1909, 1915, 1920; GG 1897 p.44, 77, 1901, p.4144; WArg 30 Sept 190; JCMWA 1903, 1905; WAMBEJ 2 Jan 1909, p.15; Reid p.185; Sprake pp.38, 129;

F. Cusack, *Canvas to Campus: A History of the Bendigo Institute of Technology*, Melbourne, 1973, p.69;

C. Rasmussen, *Increasing Momentum: Engineering at the University of Melbourne*, Melbourne, 2004, p.36.

\* Rasmussen gives this date as 1879 but the 1881 date seems more likely.



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### **NICHOLAS**, William Ellitt

Probably the son of William (above), Nicholas was at the Perseverance GMs Ltd (MMGF Webster's Find) in 1903 and represented it on the Chamber of Mines. He was the manager of Burbanks Main Lode (1904) (CGF Burbanks) between 1905 and 1915, and its consulting engineer in 1920.

GG 1904, p.3713; JCMWA 1905, 1915; Skinner 1920

### **NICHOLS**, Harry Wisdall. MAmerIME

A brother of Ralph (below), Harry Nichols qualified as both a mining and civil engineer and was elected a member of the Institute of Mining and Metallurgy of America in 1900. He arrived in Kalgoorlie in c.1901 and worked under his brother at South Kalgurli GMs Ltd (ECGF Boulder) and Great Boulder Perseverance GMg Co Ltd (ECGF Boulder). Frank Gardner, the American mining financier and speculator, had appointed R. Nichols manager of GB Perseverance, South Kalgurli and Boulder Deep Levels Ltd (ECGF Boulder) in 1898, after Gardner had gained control of these mines. Another of R. Nichols's duties was to inspect mines in Australia and North America which Gardner was considering financing. During his absences from Kalgoorlie H. Nichols acted as manager for the three mines. One such occasion was between 11 December 1903 and 1 June 1904, when R. Nichols was in London. On 7 March 1904 a cross cut at the 900 ft level on Boulder Deep Levels struck a lode which had previously been located by a borehole and by June 240 ft of the lode had been exposed. Face samples were taken every 5 ft and the average of these assays was recorded as 7 oz per ton. H. Nichols informed Gardner daily of the results but Gardner had a policy of complete secrecy and even the company board was told very little. Rumours in Kalgoorlie and London boomed the shares. On R. Nichols' return a fresh set of face samples recorded similar values as before but a closer set of roof samples averaged only 22dwt and a fenced surface stockpile returned only 15 dwt. The assay samples had been systematically 'salted' or falsely recorded. No check samples had been retained. Shares plummeted and many Kalgoorlie people lost heavily. There was great public indignation and the Government established a Royal Commission 'into matters pertaining to the Boulder Deep Levels Ltd'. The 'modus operandi' of the 'salting' was never discovered although the underground manager and chief assayist were dismissed. No evidence was found that Harry Nichols was a party to the fraud although he must have suspected that it was occurring. He resigned from Boulder Deep Levels and South Kalgurli when Bewick Moreing & Co. took over their management later in the year. In September 1904 he gave evidence to another Royal Commission which was appointed 'to inquire into matters pertaining to Great Boulder Perseverance Gold Mining Company Ltd'. The matters concerned three estimates made of the reserves of Great Boulder Perseverance, one by Ralph Nichols and the other two by W.A. Prichard and W.J. Loring (both of Bewick Moreing). Prichard's sampling had taken place while H. Nichols was acting manager in May 1904. Harry Nichols returned to the United States in 1905 where he became Curator of Geology in the Field Museum of Natural History in Chicago.

JCMWA 1903, 1904; 'RRC Boulder Deep Levels, Ltd, Kalgoorlie' V&P 1904, A13; 'RRC Great Boulder Perseverance Gold Mining Company Ltd, Kalgoorlie' V&P 1905, 3. Skinner 1905, p.22; RH.BMC

### **NICHOLS**, Ralph MIMM, MAmerIME (d.1927)

Nichols was born in New York and was educated at Columbia University from which he graduated in mining and civil engineering in 1877. He worked in the American mining industry for 20 years during which the mining properties he managed included: Big Pittsburg Consolidated Mg Co., Leadville, Colorado; Farewell Consolidated GMs, Independence, Colorado; Viola Co. Ltd, Nicholia, Idaho. He was manager of the Sutro Tunnel at the Comstock Lode in Nevada and of De La Mars GMs at Delamar, Nevada, where he was responsible for the construction and operation of what was then the

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largest cyanide plant in the USA. He came to Australia in 1897 to examine mining prospects in the eastern states for Frank Gardner, the American entrepreneur and speculator, who was based in London and Paris. When Gardner gained control of Great Boulder Perseverance GMg Co. Ltd, in 1898, he appointed Nichols its manager. Nichols also managed the other Kalgoorlie companies controlled by Gardner which in 1903 included Boulder Deep Levels Ltd (formerly Great Boulder South GMg Co. and Boulder Bonanza GMg Co.), South Kalgurli GMs Ltd and Hannan's Public Crushing, Condensing and Saw Mills Co. Ltd. Nichols continued to act as Gardner's consulting engineer inspecting prospects in North and Central America. These duties resulted in his being away from Kalgoorlie for about two months every year. These periods of absence contributed to the problems which he encountered in 1904. His brother, Harry Nichols (q.v.), acted as manager in Ralph's absence. Great Boulder Perseverance had the second highest annual gold output in the state, producing 169 thousand fine ounces in 1903, but Gardner was widely suspected of making Nichols force its production by the mining of high grade ore at the expense of necessary new development work, although the situation was masked by Gardner's policy of maintaining secrecy about the mine's operations. Nichols was largely responsible for the design and construction of the sulphide treatment plants for Great Boulder Perseverance and South Kalgurli which both commenced operation in 1901. They were both built according to the principles of Great Boulder Main Reef's successful 'dry crush and roast' process. Both used American 'long line' roasting furnaces which were improvements on the first two 'long line' roasters installed previously in Boulder but the new plants' poor extraction rates, of around 70 per cent, were still largely due to inadequate roasting. Nichols' plants were noted for their innovative use of conveyor belts and water-tube boilers. For the latter he overcame previous difficulties caused by the use of eucalypt fuel.

At the end of 1903 Herbert Hoover (q.v.), the partner in the British mining consultants, Bewick Moreing & Co., responsible for the operation of the mines which the company managed, travelled from Australia to the USA on the same ship as Nichols. They discussed the possibility of Bewick Moreing taking over the management of Great Boulder Perseverance and of Nichols becoming a Bewick Moreing employee. When Bewick Moreing discussed the possible management change with the Perseverance directors in London it was advised that the transfer would be conditional upon Bewick Moreing purchasing 38,500 Boulder Perseverance shares (worth £53,000) from Gardner who was in financial difficulties. Surprisingly, Bewick Moreing accepted the condition despite the acceptance seriously compromising the company's role as the mine's independent manager. Nichols arrived back in Kalgoorlie on 1 June 1904, in his new position as Bewick Moreing's manager of Gardner's four Kalgoorlie mines, to find two problems awaiting him. In March 1904, while Nichols was in London, high grades of gold had been recorded in face samples taken from a lode at the 900 ft level in Boulder Deep Levels Ltd. As Gardner had instructed, Harry Nichols, the acting manager, did not announce the find but, nevertheless, the company's shares rose in Kalgoorlie and in London. On Ralph Nichols' return in June he had more careful sampling done along the roof which disclosed that for several months the face samples had been systematically 'salted'. A subsequent Royal Commission was unable to determine the *modus operandi* of the fraud but Nichols dismissed the underground manager and the mine's assayer who appeared to be the main culprits. Nichols' second problem related to the extent of the reserves at Great Boulder Perseverance. On 21 April 1904, the day on which the management agreement between Boulder Perseverance and Bewick Moreing was made, Bewick Moreing's London office sent a telegram to W.A. Prichard (q.v.), the company's Kalgoorlie manager, asking him to check the extent and value of the mine's reserves. He made a rapid sampling of the mine with the help of the underground manager, Michael Flynn, and estimated that the value of the reserves was 30% less than the value of the last estimate made by Ralph Nichols on 31 December 1903. When Prichard's findings were received by the Perseverance directors on 18 May there was a marked fall in the value of the shares indicating that the directors had acted on this inside information. Subsequently, Bewick Moreing also sold, at a loss, the shares which it had bought from Gardner. While Prichard returned to London, W.J. Loring (q.v.), Bewick Moreing's

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other manager in WA, was asked to do a more thorough sampling of the mine. He found the value of the reserves to be similar to Prichard's estimate but the tonnage of reserves to be 60% lower. Ralph Nichols had by then returned to Kalgoorlie and, as requested by Bewick Moreing, the telegram giving Loring's finding was co-signed by Loring and Nichols, although Nichols said later that he considered Loring's method of sampling to be too conservative. Because of the variations in the reserves estimates and the drop in share prices Bewick Moreing's opponents in WA persuaded the Government to form a Royal Commission into the events at Boulder Perseverance. The Royal Commission recommended more standardised methods for measuring reserves and criticised Gardner for putting his own interests above those of shareholders and the directors for not advising shareholders of the state of reserves and for 'forcing' production.

In August 1904 Nichols announced that he would be returning to England to clear his name and Bewick Moreing appointed a replacement manager. However, the Royal Commission was announced soon after and Nichols remained in Kalgoorlie for the hearings and refused to hand over the mine to his successor. In October he severed his connection with Bewick Moreing and became the de facto manager of the mine reporting directly to the board in London. Surprisingly, Nichols still worked on improvements to processing equipment. In the last few months of 1904 he tested out the first movable basket vacuum filter to be used in Kalgoorlie. It was used to successfully treat tailings from a number of mines. The basket filter was based on the type which was first invented by George Moore in the USA details of which had only been published a year earlier in December 1903. In January 1905, after the reports of both Royal Commissions had been made public, Nichols sailed for London leaving George Klug (q.v.) as the independent manager of Boulder Perseverance. On 7 February at a special meeting of Perseverance shareholders in London Nichols was reappointed manager of Boulder Perseverance. However, on 12 April 1905, at the Perseverance AGM the new chairman announced that Nichols had decided to stay in England to pursue legal proceedings against Bewick Moreing. He later returned to North America where he became general manager of Avino Mines of Mexico Ltd. Subsequently, working as a consulting engineer, based in Aurora, Illinois, he examined and reported on mines in the Mexican states of Zacatecas, Durango, Sinaloa and Sonora, in most of the Western mining states of the USA and in Ontario, Canada.

Thiel p.200; Safford p.67; Skinner 1899, 1900; RH.Kalg cps 4.3, 6.2; JCMWA 1902, 1904; WAMBEJ 18 June 1904, 30 Jul 1904, 5 Jan 1907; RH.BMC cp 3; M&SP 2 April 1910; 'RRC Boulder Deep Levels Ltd, Kalgoorlie' V&P 1904, A13; 'RRC Great Boulder Perseverance Mg Co. Ltd' V&P 1905, 3; WArg 5 Jul 1900, 9 May 1905; Reid pp.237, 257; Nash 1 pp.3

### **NICHOLSON**, Charles Hope

Hope Nicholson, as he was usually called, was the brother of Ralph Nicholson (below) and came to Western Australia in the early 1890s to prospect with his brother. After several years he was working as a mine manager and by ca.1906 he was employed by Bewick Moreing & Co., mining consultant and mine manager, at mines which the company managed. In 1907 he managed Cosmopolitan Pty Ltd (NCGF) at Kookynie and, in 1908-09, South Kalgurli GMs Ltd (ECGF Boulder). In that year South Kalgurli's gold production peaked at 35 thousand fine oz which was the eleventh highest in the state that year. He was manager of Lancefield GMg Co. Ltd (MMGF Laverton) in 1911 when the difficulties encountered in treating the sulphide ore were threatening the viability of the mine. In 1913-14 he was manager of Great Fingall Consolidated (MGF Day Dawn) when the introduction of counter-current decantation helped limit rising costs.

JCMWA 1907-1913

### **NICHOLSON**, Robert Balfour MAusIME. (c.1864-1917)

Robert Nicholson, the brother of Charles Hope Nicholson (above) was born in Victoria and came to Western Australia during the Coolgardie gold rush. He was manager of Ivanhoe Gold Corporation Ltd (ECGF Boulder) from 1900 to his death

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in 1917. During that time the mine was consistently one of the top four WA producers and was largely free of management controversies and market-induced crises. Nicholson was the only leading manager to have also been a successful prospector. The two leases on the Golden Mile which he applied for in December 1893 were among the first 54 leases to be officially surveyed in Kalgoorlie-Boulder. They are shown in Fig.2 as 235 (known as Young Mt Morgan) and 750 (called the Eclipse). The former was bought by Colonial Goldfield Ltd and Nicholson forfeited the latter. Both leases became parts of Oroya Links in 1913 (Fig.4) and of North Kalgurli (1912) in 1948.

Nicholson was the manager of Paddington Consols Ltd (BAGF) in 1900 until a strike against his attempt to reduce wages caused him to resign. In July 1900 he was appointed manager of Ivanhoe G Corp after the speculator Whitaker Wright, who had controlled Ivanhoe, was bankrupted and a group of London financiers lead by F.A. Govett gained control of the company. In 1901 Govett, the new chairman of Ivanhoe, came to Kalgoorlie to reorganise the management of the two large Kalgoorlie mines formerly controlled by Wright, Lake View Consols Ltd (ECGF Boulder) and Ivanhoe G Corp. Govett retained Nicholson as manager of Ivanhoe and appointed Bewick Moreing & Co. consulting engineer to the company, an arrangement which appears to have suited all three parties. According to Gordon Young (q.v.), who was on the metallurgical staff at Ivanhoe for three years, Nicholson 'had the gift of organising and surrounding himself with competent men who gave their best work to him'. Two such men were H.E. Whitfield and T.E. Blatchford (qq.v.).

The basis of Ivanhoe's processing plant was an extension of standard stamp-mill practice except that when the slime residues began to contain an unacceptably high gold content bromocyanide treatment of the slimes was added. Nicholson's policy of minimising treatment costs at the expense of high extraction rates made the Ivanhoe one of the most profitable mines on the Golden Mile. Because of the small percentage of refractory material in the Ivanhoe ore, he was able to avoid the expense of roasting all its ore, and also of sliming all its unconcentrated tailings. By maximising amalgamation and concentration, Nicholson was able to continue using low cost percolation methods for the treatment of fine sands, and to restrict the use of bromocyanide to the slime content of the pulp. However the delay in introducing bromocyanide, in 1904, produced an unexpected problem. Instead of increasing the gold extraction rate the addition of bromocyanide actually made it worse. Analysis of the slimes found that it contained very fine pyrites which had escaped the Wilfley tables which had been specially designed to remove fine concentrates. The pyrites then had reacted adversely with the bromocyanide. After further unsuccessful adaptations of the Wilfley tables they were replaced, in 1906, by extensive traditional canvas tables which successfully removed the pyrites and the extraction rate crept up from below 80% to over 89.

The use of water from the government's piped supply from Mundaring Weir for ore processing also had unexpected consequences. When fresh 'scheme' water began to be used at Ivanhoe, instead of the local ground water, it was found that as fine concentrates were cyanided almost double the quantity of cyanide previously used was required to obtain a gold extraction of between 80 and 90%. From experiments to determine empirical corrections it was found that if 4 lbs of common salt per ton of concentrates were added to the settling vats and percolated through the concentrates the amount of cyanide required could be reduced from 3.5 lbs per ton to 2 lbs and a gold extraction of 97% obtained.

Nicholson was elected a member of the Australasian Institute of Mining Engineers in 1901. He gave evidence to the Royal Commissions on the Great Boulder Perseverance GMG Co in 1905 and on the ventilation and sanitation of mines also in 1905, and to the Royal Commission on miners' lung diseases in 1910. He was a member of the Executive Council of the Chamber of Mines of Western Australia in 1907 and was a Vice- President of the Chamber from 1907 until his death. His published papers include 'Grit mills versus Wheeler pans' *JCMWA* 2, 1903, pp.398-99; 3, 1904, pp.135-36.

*JCMWA* 1902, 1917 p.145; Skinner 1903 p.133, 1920 p.319; *MER* Feb 1912 p.191, Mar 1917 p.278; *ProcAusIMM* 29, 1918, v; *WAMBEJ* 11 Aug 1917, p.5; RH.Kalg cp.5.4; Reid p.262; *ArcAusMM*; Young p.179; DM field book (Gleddon Jun-Dec 1893) courtesy Kalg Cons GMs

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**NOWLAND**, Louis Raymond MAusIMM. (c.1887-1961)

Nowland started work as an apprentice at the Kalgoorlie Foundry in 1902 and studied at the WA School of Mines in 1906-07. He became a marine engineer with the China Navigation Company of Hong Kong in 1907. Returning ashore in 1913, he became engineer of the suction gas and steam power plant at Yuanmi GMs Ltd (EMGF Black Range) at Youanmi. The following year he was appointed chief engineer of the Medapola Mine in Ceylon and on his return to WA, in 1916, he became chief engineer of the steam plant at the Corinthian North GM (YIGF Bullfinch). After working as chief engineer of the steam and suction gas plant at Menzies Consolidated GMs Ltd (NCGF Menzies) in 1917 and of the plant at Lancefield GMs Ltd (MMGF Laverton) in 1918, he moved to Papua in 1919 to become chief engineer of Block 10 Missima Mine. He returned to Australia in 1923 to join the Ivanhoe Gold Corporation (ECGF Boulder) and then, in 1924, Wiluna Mines (EMGF Wiluna). He was appointed mechanical superintendent at Big Bell Mines Ltd (MGF Cuddingwarra) in 1945. After several years at the Eldorado Mine at Tennant Creek in the 1950s, he returned to Kalgoorlie in 1955. He was elected a member of the Australasian Institute of Mining and Metallurgy in 1949.

MYBA 1940; CEMR June 1955, p.348; CMWA 1956, 1964; M.K. Quartermaine, pers. comm. 1990; ArcAusMM

## O

**OATS**, William MLA. (1842-1911)

Oats was born in Cornwall and began work in Huel Owles tin and copper mine in 1853, aged eleven. He studied at night school and became manager of the mine in 1869. After thirty years at the mine, he emigrated, in 1884, to Victoria where he worked initially in a Bendigo gold mine. From 1885 to 1888 he was manager of a tin mine at Eurowie near Broken Hill. He moved to Western Australia in 1889 to become manager of Fraser's South GM (YIGF) at Southern Cross. In June 1890 he was also appointed manager of Fraser's GM (YIGF Southern Cross), the Yilgarn's largest gold producer. In November 1890 the company declared a dividend of 6d on 50,000 shares which was the first dividend to be paid by any mine in Western Australia. Oats, who was usually known as Captain Oats, maintained that continuity of self-funded mine development was necessary for the future of the mine but, after a disagreement with the company's directors over the payment of dividends, he resigned as manager, although continuing as manager of Fraser's South mine. In 1892 he organised gold prospecting parties to search north and east of Southern Cross. In 1893 he was chairman of the Yilgarn Roads Board and was appointed a JP in 1894. In 1895 he was elected the first Mayor of Southern Cross and in 1896 became the first president of the Kalgoorlie Chamber of Mines. In June 1896 he was manager of Brookman Brothers' Boulder GMg Co (ECGF Boulder) and Hannan's Oroya GMg Co (ECGF Boulder) and reported on several Kalgoorlie-Boulder leases for their developers, and in 1897 he was consulting engineer for 90-Mile (Goongarrie) Consolidated GMs Ltd (NCGF). In January 1897 he was vice-chairman of the Mining Conference held in Coolgardie which had a large attendance of persons from the industry. He moved to Perth in 1896 and represented Yilgarn in the Legislative Assembly between 1897 and 1904 and was MLC for the Southern Province, which included the Eastern Goldfields, from 1904 to 1910. In Perth, in c.1904, he purchased Economic Stores on William and Hay Streets. He died in 1911. His daughter, Bertha Mary, married John M. Finnerty, the respected goldfields warden, when he was the Yilgarn warden in 1891.

GG 1893 p.1240; WAGC 23 Mar 1895, 27 Feb 1897, 9 Oct 1897; WArg 26 Sept 1895, 20 Aug 1896; Skinner 1897; Black/Bolton 1 p.152; Thiel pp.333-34; Hunt pp.64-67, 157, 464, 470; Reid p.219

### P

#### **PALMER, William**

Palmer was manager of Weld Hercules GM Ltd (MGF) at Mindoolah near Cue in 1897. The mine produced 2.8 thousand fine oz of gold in two years. He was at Hannan's Oroya GMg Co. WA Ltd (ECGF Boulder) in 1902, the year in which the company amalgamated with Hannan's Brown Hill GMg Co. Ltd to form Oroya Brown Hill Co. Ltd. In 1902-03 he was Great Fingall Southern Blocks Ltd (MGF) at Day Dawn.

Skinner 1897, 1902, 1904; *WArg* 8 Mar 1900; *JCMWA* 1902, 1903

#### **PARKES, James Villiers. FGS**

Parkes became a mines inspector in the South Australian Department of Mines in 1890. He reported on the mineral wealth of the Northern Territory in 1891 and recommended the purchase of the first state gold battery at Mount Torrens. He resigned from the department in 1895 and joined the South Australian registered Australian Mining Company in Western Australia. He was general manager of Hannan's Oroya GMgCo. (Western Australia) Ltd in Kalgoorlie (ECGF Boulder) between 1897 and 1901, when 60 thousand tons of ore was crushed to produce 25 thousand oz of gold bullion. He was manager of the Star of the East (1903) GMgCo Ltd. (MGF Meekatharra) at Nannine from 1904.

*WArg* 16 Feb 1899, 12 Jul 1900; *JCMWA* 1902, 1905; Skinner 1899, 1902, 1905, 1909

#### **PATERSON, Robert Belshaw BME, AMAusIMM, AMIEAust. (c.1898-c.1975)**

Paterson graduated from Melbourne University and subsequently worked at the Morning Star Gold Mine at Woods Point. He was elected an associate member of the Australasian Institute of Mining and Metallurgy in 1922 and of the Institution of Engineers Australia in 1928. In 1924 he joined the Burma Corporation, the general manager of the operations of Burma Mines Ltd which was mining a large silver-lead deposit at Bawdin in north-eastern Burma. In 1938 he was chief surveyor at Wiluna Gold Mines Ltd (EMGF Wiluna) and was with Western Mining Corporation between 1958 and 1961.

CMWA 1952, 1960; *ArcAusMM*

#### **PATON, Adolph Ernest BE, FSASM, MAusIMM, MIMS (c.1882–c.1971)**

Paton was educated at Prince Alfred College, Adelaide, and studied engineering and science at the University of Adelaide and the South Australian School of Mines from which he graduated BSc in 1902 (upgraded to BE in 1915). Paton joined the metallurgical staff of Kalgurli GMs Ltd (ECGF Boulder) in 1904 and in 1911 was employed as surveyor and mechanical draughtsman at both Kalgurli GMs and Hainault GM Ltd (ECGF Boulder). He was a foundation member of the Institute of Mining Surveyors in 1917. In 1919 he was appointed manager of Sand Queen GMs Ltd (NCGF Menzies) at Comet Vale. The mine closed in 1920 having produced 102 thousand fine ounces of gold over ten years. After establishing a private practice in 1920 he was appointed assistant manager at Kalgurli GMs in 1921. He was metallurgist at Oroya Links Ltd (ECGF Kalgoorlie) in 1923 and then held the same position at South Kalgurli Consolidated GMs Ltd in 1924. Paton was elected a member of the Australasian Institute of Mining and Metallurgy in 1933 and in 1937 was engineering consultant for Norseman GMs Ltd (DGF Norseman) which was then approaching its peak annual production of 34 thousand fine ounces. He was assistant general manager at South Kalgurli Consolidated in 1938 and in 1942 he was manager of Croesus Pty GM (ECGF Kalgoorlie) which was owned by South Kalgurli. Paton was a member of the executive committee of the

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Western Australian Chamber of Mines in 1946. He was a director and consulting engineer for North Kalgurli from 1960 to 1965.

*WArg* 5 Feb 1920; *CEMR* Dec 1935 p.43; 1937 p.214, 1938 p.193; *CMWA* 1939, 1946; *IRMYBA* 1960, 1965; *ArcAusMM*

**PEAT**, Capt. James MAusIME, MIMS. (c.1887-1917)

Peat joined the Ivanhoe Gold Corporation Ltd (ECGF Boulder) in 1907. He gained a certificate in mine surveying from the Western Australian School of Mines in 1909 and became a surveyor with Ivanhoe in 1910. He was elected a member of the Australasian Institute of Mining Engineers in 1913. He enlisted in the AIF in 1914 and died while serving with the 44th Battalion in France.

*RDM* 1914, p.145; *ProcAusIMM* 29, 1918, p.10. *ArcAusMM*

**PIKE**, Rolfe Wilson AWASM (d.1917)

Pike was educated at Perth Boys High School and at the Western Australian School of Mines from which he graduated with an assayer's certificate in 1908 and a diploma in metallurgy in 1911. He was employed by Great Boulder Pty GMs Ltd (ECGF Boulder) in 1910, working on assaying and sampling. He worked for several months at Ravensthorpe (PRGF) before joining the Sons of Gwalia Ltd (MMGF Mt Malcolm) near Leonora. He moved to England in 1914 to work on munitions at Woolwich Arsenal, and joined the Royal Engineers (Special Brigade) in 1916. He died on active service in 1917.

*ArcAusMM*

**PITT**, Dale Latham BS, ME, MAusIMM, MIMMAmer, MCIMM (c.1880-1955)

Pitt graduated from the Utah School of Mines in 1907 and was elected a member of the American Institute of Mining and Metallurgy of America in 1916. He was appointed general manager of the Premier GMg Co at Prince in British Columbia in 1919. He came to Western Australia in 1933 as superintendent of Big Bell Mine near Cue (MG) and was appointed its general manager in 1940. In that year the mine produced 54 thousand fine oz of gold which was the fourth highest production by any mine in the state. The mine started production in 1937 and in each year until 1954, except for four, it produced more than 40 thousand fine oz. Pitt was elected a member of the Australasian Institute of Mining and Metallurgy in 1939, and was a member of the Canadian Institute of Mining and Metallurgy. On his return to the United States, he became president of the Colonial Mica Corporation NY.

*CEMR* Feb 1937 p.208, Jan 1943 p.106; *MYBA* 1940 p.126; *ArcAusMM*

**PLAYFORD**, Maxwell Ernest ME, FSASM, MAusIMM (1902-1943)

After graduating from the University of Adelaide and the South Australian School of Mines, Playford worked at the Broken Hill Associated Smelters in Port Pirie, and at Broken Hill at Mount Lyell. He moved to Western Australia when appointed assistant general manager at the Great Boulder GM Ltd (ECGF Boulder) in 1933. He became chief metallurgist at Wiluna GMs in 1934 and was appointed assistant manager at Mount Morgan GMg Co Ltd in Queensland in 1938.

*JCMWA* 1934; *Colless* p.153. *Advertiser* 12 Oct 1943. *ProcAusIMM* 131-2, 1943, xlii; *ArcAusMM*

**POLLARD**, William (d.1911)

Pollard was an experienced Cornish American mining supervisor who was recruited from the USA by Herbert Hoover to work for Bewick Moreing and Co. in Western Australia. He arrived in Kalgoorlie in 1903 where his first position was as

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underground manager at Lake View Consols Ltd (ECGF Boulder), the management of which Bewick Moreing had taken over in 1902. The previous management had selectively mined the rich parts of the mine and one of Bewick Moreing's aims was to reorganise mining so that all payable ore was mined in the most economical manner. In 1904 Pollard was appointed Bewick Moreing's first manager of White Feather Main Reefs Ltd (NCGF), a mine at Kanowna which was past its most profitable years but which its directors hoped could be revived. He gave evidence in 1904 to the Royal Commission on the Great Boulder Perseverance Mine which was looking into conflicting estimates of the mine's reserves and their consequences. When the manager of G.B. Perseverance returned to London to 'confer with the mine's directors' in 1905, Pollard was appointed acting manager until the permanent replacement, G.C. Klug (q.v.), was appointed. In 1907 Pollard became manager of Oroya Black Range (EMGF, Black Range) in Sandstone. He was also responsible for testing the embryonic mines which Bewick Moreing held under option in the Youanmi area, 90km south of Sandstone. One of the shafts, the Pollard shaft, which he sank at Youanmi was incorporated into Yuanmi GMs Ltd (EMGF) which Bewick Moreing launched in 1911. The shaft was named in his honour. Pollard was not at Oroya Black Range in 1910. Possibly he was on sick leave for, although he returned to the mine in 1911, he retired soon after and died the same year.

*WAMBEJ* 28 May 1904, p.6; 'RRC Great Boulder Perseverance Mining Company' V&P WA 1905, 3; *JCMWA* 1904, 1907, 1910. *MER* 6 March 1911, p.231; Hooper p.38 et al.

### **POMEROY**, William Arthur MIMM, MAmerIME

Educated at the Columbia School of Mines, Pomeroy worked as a mining engineer on the Mother Lode in California, in mines in Arizona and Colorado, and in iron and copper mines near Lake Superior. In 1904 he was manager for Bewick Moreing and Company of Great Fingall Consolidated Ltd (MGF) at Day Dawn. He gave evidence to the Royal Commission on Non-British Labour in 1904 and to the Select Committee on Ventilation and Sanitation in 1905. He was elected a member of the Institution of Mining and Metallurgy and also of the Institute of Mining and Metallurgy of America in 1904. He was chairman of the Murchison local committee of the Chamber of Mines of Western Australia in the same year. In ca. 1908 he was superintendent of the King of Arizona mine and was possibly at the Santa Maria del Oro mine in Mexico in ca. 1909. He was subsequently a consulting engineer in New York.

Skinner 1905; *JCMWA* 1904; *WAMBEJ* 18 Sept 1909, p.5

### **POWELL**, Frank Barcham

In 1903 Powell was a partner of R.A.W. Black, T. Blatchford and A.E. Thomas (all qqv) in an assay and metallurgical company and subsequently was metallurgist at the Broad Arrow Consols GM Co Ltd (BAGF) at Broad Arrow. Powell gave evidence to the Royal Commission on the Great Boulder Perseverance Mine in 1905. He was in Melbourne in 1910 and in Hokitika, New Zealand, in 1917. He was an associate of the WA Chamber of Mines between 1910 and 1919.

GG 1904 p.908; *WAMBEJ* 8 Jul 1905 p.6; 27 Feb 1909 p.15; *JCMWA* 1910, 1919

### **PRICE**, Edward Graham (1872-1911)

Born in England at Chatham and educated at Christ's Hospital Bluecoat School, Price arrived in Western Australia in 1889. He practiced as an accountant in Perth until 1894 when he moved to Coolgardie. In 1898 he was agent for Darlot Exploration Company of Western Australia Ltd, which had mines at Mt Remarkable (NCGF) and at Diorite (MMGF), and in 1899 agent for British Coolgardie Ltd. In 1899 he established E. Graham Price and Company as a mining company consultant. In 1902 he was associated with Hampton Properties Ltd which encompassed Hampton Plains Block 40 (NECGF) and Blocks 45 and 56 (ECGF) and also with Hannan's Star GMs Ltd.(ECGF Boulder). In 1903 he was associated



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with Block 42 Hampton Plains Ltd (NECGF) and with West Australian Goldfields Ltd. He was attorney for Menzies Alpha Leases Ltd. (NCGF Menzies) between 1903 and 1907, for Red Hill Westralia GMs Ltd (CGF Red Hill) in 1904, for Boulder Deep Levels (1907) Ltd. (ECGF Boulder) in 1908, and for Brownhill Extended Ltd (ECGF Kalgoorlie) in 1908-10. He was attorney for Hampton Plains Estate Ltd (Hampton Plains within CGF including its water works and brickworks) between 1903 and 1907 and, in 1911 was its general manager. In 1911 he was also general manager of the Kalgoorlie Electric Tramways Ltd and of Westralia Timber and Firewood Company which ran a woodline south-east from Kurramia, on the Kalgoorlie to Kanowna railway, passing through Bulong. Price was also a local director of the London-owned Perth Tramways in 1911.

GG 1897, p.347; Skinner 1899, 1900; *JCMWA* 1902, 1911; *WAMBEJ* 14 Mar 1903 p.8, 7 May 1904 p.5; Battye 2, pp.888-89; *ProcAusIMM* NS5, 1912, p.19; Gibney /Smith 2, p.189; G&A pp.166,273; MacGill, pp.10-14

### **PRICHARD**, William Anthony, AB MIMM MAmerIME

Prichard graduated from Stanford University, California, in mining and geology in 1898. In his 1897 summer vacation he worked for the United States Geological Survey and on his graduation the USGS employed him as an assistant geologist. In 1899 he was appointed manager of the Keystone Consolidated Mining Co. in Amador County, California, in the 'Mother Lode' locality. In October 1901 he was offered the position of superintendent of a mine in Western Australia managed by Bewick Moreing & Co., the English mining consultants and mine managers. The offer, which Prichard accepted, was made by H.C. Hoover (q.v.), a partner in Bewick Moreing, who was the brother of Prichard's friend, T. Hoover. Prichard met Herbert Hoover in Perth in January 1902. Prichard had been originally engaged to be manager of the Sons of Gwalia Ltd (MMGF Leonora) but Bewick Moreing had recently been appointed manager of Lake View Consols (ECGF Boulder) and Prichard was assigned to that mine instead. F.P. Govett, a London stockbroker, who was the new chairman of Lake View Consols had appointed Bewick Moreing general manager of Lake View Consols after he had travelled out to Australia on the same ship as Hoover. Prichard took over the mine in February 1902. The Lake View mine needed major rehabilitation after Whitaker Wright, the entrepreneur who had controlled the mine until 1899, had plundered the very rich parts of the mine for bull runs on the share market. Under Wright the mine's forced production, in 1899, reached a peak of 236 thousand bullion ounces (or 170,000 fine ounces). Under Bewick Moreing production was 57 thousand fine ounces in 1903 and during the rest of the decade was stabilised at an average of 44 thousand fine ounces, most of which was produced by the mine's Diehl sulphide treatment process. In January 1903, W.R. Feldtmann (q.v.), the Bewick Moreing WA general manager, resigned and Hoover appointed Prichard and, another American, W.J. Loring (q.v.), as joint general managers, with Prichard responsible for the mines managed by the company in Kalgoorlie-Boulder and Loring, who had been manager of the Sons of Gwalia Ltd mine since 1902, responsible for those in the rest of the state. In mid-1903 five mines on the Kalgoorlie-Boulder Golden Mile were under Prichard's general management. During 1903 and 1904 Bewick Moreing carried out a very successful public relations exercise in which Prichard was the main Kalgoorlie participant and Hoover and C.A. Moreing, the senior partner of Bewick Moreing, the London ones. At a time when almost every major Kalgoorlie mine was reducing its costs Bewick Moreing's common accounting system for all its mines allowed it to compare how costs at the mines it managed had been reduced. This was used to demonstrate the effectiveness of Bewick Moreing's management. The company claimed that a mine's 'working costs' which it defined as the cost of mining ore, bringing it to surface and treating it to remove the gold, divided by the tonnage of ore treated, was the true means by which the efficiency of different mines could be compared. This was misleading because different ores required different degrees of treatment and working costs gave no indication of the efficiency of a treatment process. J.S. Sutherland (q.v.) of Golden Horseshoe Estates (ECGF Boulder) and Prichard exchanged articles and letters in the *Journal of the Chamber of Mines* the

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terminology of which became quite 'robust' for a journal in which mine managers seldom criticised one another. Sutherland argued that 'total costs' were the only true means of comparison and Prichard argued for 'working costs'. In 1904 Hoover and Moreing made agreements with the directors of the two most productive Kalgoorlie mines, Golden Horseshoe Estates and Great Boulder Perseverance, for Bewick Moreing to take over the management of both mines. Both agreements contained unusual conditions which were the cause of Bewick Moreing's dismissal as manager of both mines by the end of 1904. When the Boulder Perseverance contract was signed in April 1904 Prichard was asked by the London office to 'send us [an] estimate of ore reserves' Believing that the company had previously over-estimated the reserves and wishing to warn the London office, he made a rapid sampling of the mine from which he estimated that the manager's previous estimate of the value of the reserves had been 30% in excess of the true value. Prichard returned to London while Loring was asked to do a more thorough sampling. Prichard came back to Perth and gave evidence at a Royal Commission into matters related to Great Boulder Perseverance. In its findings he was criticised for not having made a more thorough sampling. Shortly after, he resigned from Bewick Moreing and returned to London. As he was a vice-president of the Chamber of Mines he was given a farewell dinner by the Chamber at which he was praised for his efforts to standardise the accounting methods for mines.

In 1905 Prichard established a mining consultancy in London and was consulting engineer for the Oroville Dredging Company in California, an association which he maintained into the 1920s when he was a director of the company. In 1910 he was a mining consultant in Mexico with an office in Mexico City and was the representative of the Anglo-Continental Gold Syndicate (1899) Ltd in Mexico. He was a member of Sociedad Geologica de Mexico and of the executive council of the Camera Minera of Mexico. In 1915 he was the consultant to the Pato project, a British gold dredging enterprise in Colombia, South America. He was one of its directors in 1920 when he was also a director of the Colombian Mines Corporation Ltd and of the Neche mine in Colombia. He was elected a member of the Institution of Mining and Metallurgy in 1904.

His publications include: 'Uniform cost returns and comparison of costs for month of July 1903', *JCMWA* 2, 1903, pp.236, 280-81; 'Uniform cost returns', *E&MJ* 31 October 1903, p.655 (*JCMWA* article abridged);

'Filter pressing in Western Australia', *WAMBEJ* 11 June 1904, pp.12-13 (reprint from *E&MJ*)

(with H.C. Hoover) 'The treatment of sulpho-telluride ores at Kalgoorlie', *E&MJ* 1 August 1903, pp.156-57.

*WArg* 11 Nov 1902; *WAMBEJ* 17 Oct 1903, 2 Jan 1904, 16 Apr 1904, 23 Apr 1904, 18 Jun 1904, 29 Oct 1904, 12 Nov 1904, 3 Jan 1905, 10 Jun 1905; *GG* 1904, p.780; Skinner 1905, 1915; *TIMM* 33, 1927, p.537; Nash 1 cp.16; RH.BMC thesis cp.3; Safford; *MMg* Mar 1915; 'RRC GB Perseverance Mg Co.' V&P WA 1905, 3

**PRIOR**, Charles Edward MAmIMME, MAusIMM. (1891-1972)

Born in Ohio in the United States, Prior studied engineering at the Colorado School of Mines and did post-graduate studies at Columbia School of Mines. After several years working in the British Columbian mining industry and mining silver in Mexico, he was elected a member of the Institute of Mining and Metallurgy in 1916. He joined the US Army in 1917 and was promoted to Captain in France. After World War I ended, he worked as a mining engineer in Nevada, and again in British Columbia and Mexico. He moved to Western Australia as manager of Wiluna Gold Mines Ltd. (EMGF) in 1928 and was appointed managing director of this company in 1935. He became a consulting engineer to Goldfields Australian Development, controlling the Moonlight mine at Wiluna in 1937 and a director of the Western Australian Cement Company in 1938. He was an executive councillor of the Chamber of Mines of Western Australia. He returned to Canada in 1939 and joined the American Smelting and Refining Company (ASARCO) and then Lake Asbestos of Quebec. His publications include: 'Wiluna ore treatment ...' *CEMR* Feb 1937, pp.201-2.

*CMWA* 1929, 1934; Reid pp.63-64; Colless p.155; *CEMR* Aug 1937 p.425, Aug 1939 p.452; *ArcAusMM*

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### **PROVIS**, Richard AMICE

In 1896 Provis was general manager in Tasmania of the Tasmanian Land and Exploration Company and was a consultant to the Anglo-Continental Gold Syndicate Ltd whose directors were Carl Wichmann, Edmund Davis and Walton F. Turner. Provis moved to Western Australia, where, in 1897, he was attorney for the Woodley's Reward GM (Yalgoo GF) and Anglo-Continental Gold Syndicate Ltd. In 1897-99, he was manager of the United Australian Exploration Ltd (MMGF, Mt Morgans).

WAGC 16 Jan 1897 ; GG 1897 p.345.

## R

### **RAYFIELD**, John William (b.1864)

Rayfield was born in Bendigo and commenced work in the Bendigo mines at an early age. In 1884 he moved to South Australia where he worked as an engineer at a number of mines. He then spent nine years working in New England and Queensland as a mining consultant and a manager of mines and processing works. In 1896 he moved to Western Australia where he opened up Cue No.1 GM in the Murchison Goldfield and operated the mine until the company was floated. He did the same for the Lake Way GM for the Western Australian Goldfields Ltd. In 1897 he moved to Menzies (NCGF) where he was the consulting mining engineer to three gold mines, the Florence GM, Lady Shenton GM, and Menzies Alpha Leases GM. In 1902-04 he was manager of the Lady Shenton GM which was the largest gold producer in the Menzies district. In each of the five years from 1898 to 1902 the mine produced over 20 thousand bullion ounces of gold. Its peak production of 25 thousand bullion ounces, in 1901, was the thirteenth highest total produced by a WA mine in that year (and the ninth for a mine outside Kalgoorlie). However, production fell off rapidly in 1903 and Rayfield closed the mine in 1904. He was an enthusiastic inventor of improvements to mining and ore processing equipment. In 1901 he applied for WA patent 3539 'Improved tap for filter press' and also for WA patent 3158 'Process of direct smelting and purifying gold precipitates or base bullion' with C.E. Manta. In 1902 he applied for WA patent 3740 'An improved safety cage' 1902 with C. Robinson. Rayfield was the mayor of Menzies in 1901.

GG 1901 p.72, 1902 p.1187; Skinner 1899, 1903, 1904; JCMWA 1902, 1904; RH.Kalg tab 4; Thiel pp.666-67

### **READ**, Henry Lawrence

Read was the attorney for the Lady Charlotte GM at Bardoc (BAGF) in 1899 and was the representative in the Eastern Goldfields of Bainbridge Seymour and Company, mining consultants and mine managers, in 1901. He was the manager of the Lady Emily GM at Coolgardie in 1901 and of Kalgoorlie Mint and Iron King GM Co (ECGF Boulder) in 1901-03. He was general manager of the Zoroastrian GM at Bardoc (BAGF) in 1903-06.

GG 1901, p.1200; JCMWA 1903, 1906; Skinner 1903, 1904, 1905

### **RHYS**, Theophilus Tudor MAusIME

After working in the Victorian mining industry Rhys arrived in Western Australia in 1891, working initially at Nannine. He joined the Australasian Institute of Mining Engineers in 1894, and was a member of the Coolgardie Mine Managers Institute in 1897. He was manager of the Vale of Coolgardie GMs Ltd. at Bonnievale (CGF) between 1898 and 1908. In its nine

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years of operation the mine produced 39 thousand fine ounces of gold and paid a single dividend of £5,625 in 1900. Rhys gave evidence to the Select Committee on Ventilation and Sanitation of Mines in 1905.

WAGC 18 Sept 1897 p.12, 22 Jan 1898 p.7; JCMWA 1902, 1908

**RIDGWAY**, George

(b.1867)

Ridgway was born at Crawley in the English county of Buckinghamshire and was educated at Old Stratford. He served a five year apprenticeship at the Watling Engineering Works in Stony Stratford and also studied at South Kensington Technical School in London. In 1888 he emigrated to Melbourne where he became the engineer-manager for two brickworks (in succession). In 1894 he moved to Western Australia and after a short stay in Perth travelled to the goldfields where, with a partner, he built and operated a water supply condenser at Black Flag which was 20 miles from Coolgardie on the Ora Banda road. He returned to Midland Junction where, in partnership with his brother, he operated a brick-making business for two years. He returned to the goldfields in 1898 and, after working initially for Lake View South GM (WA) Ltd (ECGF Boulder), he was reported to have worked on the erection of the sulphide plant for Great Boulder Pty Ltd (ECGF Boulder). This presumably was the Koneman (q.v.) sulphide plant which was built at Great Boulder in 1898 and the beginning of 1899. It was a very innovative, cost effective process and almost succeeded but, in February 1899, after the last stage to be completed failed, the plant could not be accepted and was demolished. In 1900 Ridgway was appointed engineer for Great Boulder, a post he held for three years during which he supervised the construction of Great Boulder's first successful sulphide plant which was a 'dry crush and roast' process along the lines of the prototype at Great Boulder Main Reef but incorporating the first Edwards roasting furnaces to be used in Kalgoorlie which at that time were also the most effective. From 1903 to 1905 Ridgway was manager of Princess Royal GMg Co. (DGF) which was 8km north of Norseman. The mine's annual production peaked in 1903 at 24 thousand fine oz which was the sixth highest total that year for any mine outside Kalgoorlie. He returned to Great Boulder in 1905 as engineer and assistant manager under R. Hamilton.

Ridgway was a prolific inventor. Between 1903 and 1911 he applied for 9 different metallurgical patents through the Kalgoorlie patent attorney, W.G. Manners (q.v.). His first application for a Commonwealth patent, for a 'rotary slimes filter', made shortly after his return to Great Boulder, was for a provisional patent as the operating details had not been fully worked out. No time was wasted in building the prototype and, by January 1906, it was working alongside the existing filter presses. A new patent application accompanied by a complete specification relating to what was now termed 'an atmospheric filter' (that is, one operating under atmospheric pressure rather than one which was pressurised) was applied for on 7 February 1906 and was sealed on 12 September 1906 (5200 of 1906). After the prototype had worked for a year without any problems, Hamilton ordered a further ten which came into operation in mid-1907, Great Boulder thereby becoming the first Kalgoorlie mine to replace a large number of its filter presses with vacuum filters.

The Ridgway vacuum filter was the only continuous, high volume, automatically operated vacuum filter system in use in the 1900s. It was different in form and construction to other vacuum filters and had a sophisticated, yet basically simple, control system. Moreover, it had a low operating cost which was about a third of that of filter-pressing and also a very high extraction rate which, in 1908, A. James in his annual review of improvements in cyanidation claimed to have an almost impossible average removal of 99.5 per cent.. Unlike the American vacuum filters it did not require full time attendance and manual control. Few metallurgical innovations in the previous twenty years had been received with such international enthusiasm as the Ridgway filter. Manufactured under licence in Britain its use spread remarkably quickly and by the end of 1907 it was operating in new plants in such diverse fields as Mexico and Korea. Yet its international popularity waned rapidly as it was too advanced a concept for general use around the world without specialised advice being provided to its

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users and adjustment made to its controls to suit the particular composition of the slimes being treated. Even at Great Boulder the Ridgway filter was unable to accommodate rapid increases in treatment plant residues which mysteriously occurred in 1908 and 1909. The problem was caused by significant quantities of graphite near the walls of the lode below the 2400 ft level which tended to precipitate out gold prematurely from the gold solution. An inexpensive way of retreating such residues was developed by von Bernewitz (q.v.) at the Associated Northern mine, using a short dilute cyanide wash in filter presses, but such a non-standard wash was impossible with the Ridgway filter and Hamilton was forced to put the pulp through the whole agitation and filtration cycle again. Better selection of stoped ore and the avoidance of ore from lode walls in the lower levels eased the problem. Ridgway developed his filter by increasing its capacity by substituting the horizontal 'paddle' shaped filters with baskets of vertical filters. Filters on this Mk 2 unit had a surface area eight times those on the original Mk 1 unit and the new unit had a nominal capacity of 500 tons of dry pulp, ten times that of the original model. A prototype was set up and worked in parallel with the Mk 1 units for over a year and two production units were later installed. In 1911 Ridgway developed a third vacuum filter model which combined the washing capacity of Mk 1 with the output of the second. It was intended for use on several outback mines which were then being developed by Kalgoorlie mines. At least one of these, at Bullfinch (YIGF), Mk 3 vacuum filters was installed and gave excellent service. The Mk 3 model combined features of the Mk 1 model with some of those of the American basket filters. Its gold recovery percentage was estimated to be over 90 per cent and it was probably cheaper to operate than other basket vacuum filters because of its simpler method of mechanical handling. It had great potential for further improvement but the Bullfinch mine was only a short term one which closed in 1922 so the impact of the Mk 3 filter was of only short term, local significance.

In 1915 Ridgway, Hamilton and F.A. Moss (q.v.) formed a syndicate to purchase the Lancefield gold mine (MMGF), five miles north of Laverton, from Beria Consols. The mine's refractory ore contained arsenopyrite which previous operators had found difficult to treat profitably. The syndicate successfully adopted the Kalgoorlie 'dry crush and roast' treatment method using Krupp ball mills and Edward duplex roasters. The mine, which was managed by Moss, operated until 1921 when it was closed because of rising costs. In 1915-21 the syndicate paid £128,000 in dividends.

Ridgway also had interests in coal mining and, before 1920, floated the Westralia Coal Mine Company Ltd. In 1920 he was a director of the Celebration Junction Option Company at Hampton Plains.

In August 1933, a new company, Lancefield (WA) G.M.s N.L., of which Ridgway was managing director, was formed in Melbourne to reopen the Lancefield mine. The company successfully adopted the same ore treatment method of flotation, roasting and cyanidation which had been used at Wiluna on its arsenopyrite ore. The mine produced over 30 thousand fine oz of gold in each of the four years from 1936 to 1939 but in 1940 diminishing ore supplies caused the mine to close. Ridgway was chairman of the Norseman local committee of the Chamber of Mines in 1904-05. He retired in 1940. His papers include: 'Developing the Lancefield: description of mine, unwatering operations and new mill', *CEMR* 5 May 1934, pp.309-12. He registered several Commonwealth patents. Provisional no.3703 of 1905 for 'a rotary slimes filter' was not completed; no.5200 of 1906 for 'an atmospheric filter' was completed and renewed in 1913; no.5329 of 1906 for 'improvements in atmospheric filters' was completed and renewed in 1913; no.10868 of 1908 for 'improvements in filtering machines' was completed and renewed in 1915; no.18458 of 1910 for 'improvements in ore and pulp filters' was completed; no.1790 of 1911 for 'improvements in filtering machines' was completed.

*WAMBEJ* 12 Dec 1903, 1 Oct 1908, 5 Jun 1915; *RH.Kalg*, cp.6.4; *JCMWA* 1905, 1908, 1913, 1920; *Battye* 2, p.347-48; *W.G. Manners' Patent Register* (Western Australia 1903, Commonwealth of Australia 1904-1922); *WArg* 10 Mar 1920; *Colless* p.158; *MYBA* 1940; *CEMR* 10 October 1946, pp.11-14; *Patent Register of W.G. Manners*

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**ROBERTS**, George Moyses ABalSM, MIMM, MIMMAmer, MAusIMM (1866-1930)

Roberts was born at Clare in South Australia and was educated at its local school. He worked on his father's farm for six years, until 1886, when he enrolled at the Ballarat School of Mines where he studied metallurgy, mining and surveying. In 1889 he joined the Broken Hill Proprietary Co. Ltd in Broken Hill where he worked as an analytical chemist until 1895 when he moved to Western Australia to become manager of Mainland Consols Ltd. (MGF) at Mainland near Lake Austin. In its four years of operation the mine produced 19,640 fine oz of gold at a good yield of 3.4 oz per ton. Roberts joined the staff of Lake View Consols Ltd (ECGF) at Boulder in 1898 and, in the same year, was sent to New South Wales for three months to supervise the smelting of some of the mine's very rich sulpho-telluride ore at Australian Smelting Company's smelter at Dapto near Wollongong. On his return to Lake View, in 1899, Roberts was appointed the company's metallurgist and assistant manager. 1899 was a difficult year for Lake View as the very rich ore in the mine was running out and Whitaker Wright, who controlled the company, was bankrupted by a bear run on its shares. The mine's manager, Callahan (q.v.), was recalled to London but, before leaving, he agreed to the London and Hamburg Company carrying out a trial treatment of the mine's sulpho-telluride ore using the still un-proven process devised by Dr Diehl (q.v.) in which both cyanide and bromocyanide were used to treat the finely ground tailings. Roberts supervised the trial, in January 1900, which was a complete success. In May 1900, after a year at Lake View, Roberts was appointed metallurgist and assistant manager at Great Boulder Pty under R. Hamilton (q.v.) where he was involved in commissioning a sulphide plant to replace the Koneman plant which had failed in 1899 (see Koneman). The new plant, designed by Hamilton, was similar to the 'dry crush, roast and sliming' process first devised by J.T. Marriner (q.v.) at Great Boulder Main Reef. Robert's first task at Great Boulder was to supervise the trial roasting of Great Boulder sulphide ore at Ballarat using an Edwards roasting furnace which had been developed there by Thomas Edwards. It was a long line, reverberatory furnace with a single gas-fired fire-box at the outlet end. Its advantages over the American furnaces, used previously at Kalgoorlie, were that the angle of its hearth could be varied, it had revolving rabblers fixed through its roof and had a casing which could be pre-fabricated. The trial was a success except that supplementary burners were required along the furnace. Twelve furnaces were installed, the majority being producer gas-fired but with several provided with wood-firing for comparison. Once the art of firing with eucalypt had been mastered, wood-firing proved the cheaper and more effective method, and the gas-fired furnaces were converted to wood-firing. By 1902 very high extraction rates of 93-95 per cent were obtained but roasting was still not entirely satisfactory, so when further expansion was required, in 1902, Roberts returned to Victoria to supervise another trial roasting of Great Boulder sulphide ore in a furnace developed by T.D. Merton of Spotswood Refining & Metallurgical Works near Melbourne. This was a more compact furnace than the Edwards furnace with three hearths over each other with the ore dropping from the top one, stirred on each hearth by fixed rotating rabblers similar to those of Edwards. The advantage of the furnace was that it lost less heat and had a greater capacity. The trial was a success and Roberts recommended the installation of six at Great Boulder which became operational in early 1903. After four years at Great Boulder, in 1904 Roberts was appointed manager of Associated Northern Blocks (WA) Ltd (ECGF Boulder) following the death of William Rodda (q.v.). The company mined the Iron Duke lease, and in 1905 produced 44 thousand fine oz of gold which was the eleventh highest in the state that year. Roberts installed six Merton furnaces at the mine to roast its sulphide ore in its treatment process using the 'dry crush, roast and sliming process'. In 1906 Pierre Ledoux (q.v.), the Belgian mining consultant, who had been acting manager of Associated GMs (WA) Ltd since 1904, returned to Belgium and Roberts was appointed manager of Associated GMs, a responsibility which was in addition to his management of Associated Northern Blocks and which put him in the unique position of managing two major mines on the Golden Mile. In 1907 Associated GMs produced 57 thousand fine oz of gold which was the ninth highest in the state that year. In 1909

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Roberts was criticised for not giving sufficient priority to 'blocking out' (proving on three sides) new reserves for Associated. He admitted that their estimated grade was based on assays from stopes already being mined. In 1910 E.H. Liveing, the company's consultant, reported that reserves were 'low grade and pockety' and their extent could not be determined accurately. After being further criticised for relying too much on his subordinates, in 1911 Roberts resigned as manager of Associated to concentrate on the management of Associated Northern Blocks and a new mine at Siberia (BAGF) with which the company planned to replace Associated Northern. The mine at Siberia operated for ten years producing 91 thousand fine oz of gold. It was one of four mines outside Kalgoorlie which used for gold extraction the Ridgway vacuum filter Mk 2, an automatically operated filter invented by George Ridgway (q.v.), the engineer at Great Boulder Pty. Mk.2 was an adaptation of his very successful Mk.1 filter used at Great Boulder. Instead of the flat plate filter used in Mk.1, Mk.2 had a basket of five vertical filters and operated at a much slower speed but was able to process over 600 tons of dry pulp per day, ten times that of Mk.1. Roberts was manager of Associated Northern until it closed in 1927. Its post-war peak production was 27 thousand fine oz in 1919. During the 1920s it had an average annual production of only 4 thousand fine oz.

Roberts was elected to membership of the Institute of Mining and Metallurgy of America in 1892, the Institution of Mining and Metallurgy (UK) in 1906 and of the Australasian Institute of Mining Engineers in 1909. He was a member of the Senate of the University of Western Australia from 1912 until his death. His published papers include: 'Description of the ore treatment plant on the Great Boulder Gold Mine Kalgoorlie', *JCMWA* 1, 1902: Part 1, pp.110-13; Part 2, pp.135-37; Part 3, pp.313-15.

*JCMWA* 1902, 1903, 1929; Clark p.91; RH.Kalg, cp.6.4, tab 4; Battye 2, pp.344-45; Skinner 1915, 1920; *WWA* 1927-28, p.218; *ProcIMM* 1931-32, p.659; *ProcAusIMM* 79, 1930, lxxviii; Gibney/Smith 2, p.217; *ArcAusMM*; Reid, pp.264, 268

### **ROBERTS**, William George MAusIME

Roberts worked in the Victorian and South Australian mining industries for 22 years before going to Western Australia in 1896 where he became the underground manager at the Associated Northern Blocks (WA) mine at Boulder (ECGF). He gave evidence to the Select Committee on Ventilation and Sanitation of Mines in 1905, and was elected a member of the Australasian Institute of Mining Engineers in 1909.

*JCMWA* 1907, 1912; 'RSC Ventilation and Sanitation of Mines' V&P 1905, 6

### **ROBERTSON**, Horace Patrick BCE, AMICE, MIMM

After graduating in civil engineering from Melbourne University in 1893 Robertson worked for the Western Wimmera Investment Trust. He moved to Western Australia in 1894 where he was employed as a principal assistant engineer in the Public Works Department. He was working under T.C. Hodgson who was to become Engineer-in-charge of the Coolgardie Water Supply Scheme and in September and October 1895 Robertson carried out the initial calculations for the 520km water supply pipeline from Mundaring to Kalgoorlie. These determined that the pipeline was to be the world's first major pipeline in steel, the probable diameter of the pipes and the number of pumping stations required. The only major difference between the Scheme which was completed in 1903 and Robertson's 1895 trial scheme was a variation in the number of pumping stations and in their locations. Progress on the scheme stalled in 1896 while the Engineer-in-Chief, C.Y. O'Connor, sought parliamentary approval for the scheme. In October 1896 Robertson resigned from the Public Works Department to seek employment in the mining industry. From 1899 until 1904 he was manager of Lake View and Boulder Junction GMs Ltd whose leases were in the east-central part of the Golden Mile but these were abandoned in 1904. In 1909 Robertson

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was manager of Gwalia Consolidated Ltd (EMGF Wiluna after which Robertson went to work in North Queensland and then Mexico. He returned to Western Australia in the 1930s.

*JCMWA* 1902, 1904; Skinner 1904; *MMg* Feb 1939, p.104; Officers of PWD for year ending 30 June 1897

**RODDA**, Stanley Northey MAusIME (1868-1939)

Born in California, Rodda worked as a mining engineer in the United States, Canada, South Africa, West Africa and Mexico. In 1902 he was in Western Australia at Associated Northern Blocks (WA) Ltd. in Boulder (ECGF). He was general manager of the copper mining company, Mungana (Chilligoe) Mining Company, in Queensland in 1910. In the same year he was elected a member of the Australasian Institute of Mining Engineers, and subsequently became Principal of the School of Mines at the Working Men's College in Melbourne.

*JCMWA* 1902; Gibney/Smith 2, p.223; ArcAusMM

**RODDA**, William H. (d.1903)

Born in Cornwall and experienced in mining in California, Idaho, and Nevada, Rodda also worked in Johannesburg. He arrived in Western Australia in ca. 1899. He was manager of Associated Northern Blocks (WA) Ltd (ECGF Boulder) in 1899 and remained with the company until his death in 1903. He was a Vice-President of the Chamber of Mines in 1902.

Thiel p.201; *WAMBEJ* 16 May 1903, p.16; *JCMWA* 1903; M.K. Quartermaine, pers. com. 1990

**ROLFE**, Frederick Percy ARSM, MIMM (1884-1918)

Rolfe was born in the County of Norfolk, England, and studied at the Royal School of Mines from which he graduated as ARSM in 1903. He was awarded the 1903 School Medal and an Institution of Mining and Metallurgy postgraduate traveling scholarship. In 1902 he studied mining and metallurgy in Spain and from 1903-06 he was in Western Australia where he took his two years postgraduate course at the Sons of Gwalia mine (MMGF) and South Kalgurli GMs (ECGF) and was subsequently chief sampler at Lake View Consols (ECGF Boulder). In 1907 he visited the goldfields of Waihi and Thames (New Zealand), Mother Lode (California), Tonopah (Nevada) and Cripple Creek (Colorado) and was general manager of the Keystone GM in Wyoming. In 1908 he became superintendent of the Colombian Mining & Exploration Co. in Colombia and in 1910 he was appointed general manager of Spanish Mines Consolidated Ltd which was working lead, zinc and silver mines in Spain. From 1912 to 1914 he was acting manager or manager of three mines in the Barnato group in the Transvaal. He was admitted to membership of the Institution of Mining and Metallurgy in 1914. In the same year he became manager of the Fred Mine at Filibusi in Southern Rhodesia where, in 1918, he died from Spanish flu, aged 34. His publications include: 'Shrinkage stoping in Western Australia', *TransIMM* vol.18 and 'Illogical precision in mine reports', *TransIMM* vol. 21.

*TransIMM* vol. 29 (1919-20)

**ROWE**, Frederick Walton MAusIMM (b.c.1886)

Rowe studied at University College London for one year and at Camborne School of Mines in 1904-6. He moved to Western Australia in 1906 and worked initially at Lake View Consols Ltd (ECGF Boulder). He worked in the treatment plants of South Kalgurli GMs (ECGF Boulder) in 1907, and of the Oroya Brownhill Co. Ltd (ECGF Boulder/Kalgoorlie) in 1908-9. He became the 'experimentalist' at Oroya Links Ltd (ECGF Kalgoorlie) in 1909, and its assayer in 1911. He was elected a



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member of the Australasian Institute of Mining Engineers in 1913 and remained at Oroya Links until after 1922.

ArcAusMM

### **ROWE, W.C.** MAusIME

Rowe started mining work in the Eastern colonies in 1860 and became a mine manager in 1875. He moved to Western Australia to become the manager of Hannan's Maritana GM (ECGF Kalgoorlie) in 1895. He was elected a member of the Australasian Institute of Mining Engineers in 1897, and helped establish the Mine Managers Association in Kalgoorlie in 1898. He was manager of the Associated Southern GMs (WA) Ltd (ECGF Boulder) in 1898. In 1901 he was manager of the Lady Evelyn GMs Ltd at Cashmans near Ora Banda which closed in that year having produced 2,112 fine ounces from 2,770 tons of ore.

WArg 19 Jan 1895, WAGC 11 May 1897 p.17; Skinner 1899; Reid p.181; ArcAusMM

### **ROWLEY, Henry** MIEE, MVIE, FCS (c.1840-1919)

Born in South Australia and taken to the Victorian goldfields by his parents, Rowley served an apprenticeship at the Vivien Company's foundry in Castlemaine. He was elected a member of the Victorian Institution of Engineers in 1884, and was the engineer for the tramway beside the Exhibition Building in Melbourne. After moving to Perth in ca. 1896 he established a practice as a consulting electrical and chemical engineer and assayer. He gave evidence to the 1900 Select Committee on the Perth Electric Tramways Lighting and Power Bill and became the analyst for the City of Perth in 1900. He applied for a number of Commonwealth patents, including one for 'A process and means of rendering rock phosphate easily soluble' 1907; patent 7717 'A method and process for treating ferro-silicated-alumina ... fungicidal and fertilising purpose' 1913; and 'A process for the extraction of ... gum from xanthorrea' 1913. He was a partner of Holroyd (q.v.) in 1905.

KM 11 Nov 1898; WAMBEJ 11 Apr 1903, 5 Jan 1907; JCMWA 1902; Gibney/Smith 2, p.231

### **RYAN, Denis Leonard** AMAusIMM (b.c.1881)

After studying chemistry and assaying at the Ballarat School of Mines, and working at a battery, Ryan moved to Kalgoorlie in 1903 to work in the processing mill of the Golden Horse-shoe Estates Company (ECGF Boulder). He later represented this company at the Fremantle smelter which was treating (at various times) the mine's sulphide and sulpho-telluride ores, its concentrates and gold-room slag. (See Kaufman and Klug for the development of the Fremantle smelter). Ryan became the assayer at the Golden Horse-shoe in 1909 and in 1911 the chief assayer for the Fremantle Trading Company at its Fremantle smelter. The Fremantle Trading Co. had taken over the Klug-designed Fremantle smelter when it was no longer required to smelt gold ore and used it to smelt lead and copper ores from its Northampton mines. Ryan was elected an associate member of the Australasian Institute of Mining and Metallurgy in 1917, and worked for the Fremantle Trading Company until after 1925 when copper and lead mining and smelting was no longer profitable.

JCMWA 1917, 1920; ArcAusMM; JAusMH v.1, no.1, Sept 2003, pp.169-78

## S

**SAUNDERS**, Henry John MICE

(1855-1919)

Born in England, at Bradford-on-Avon, and educated at Clifton College in Bristol and at Crystal Palace School of Engineering in London, Saunders served articles with H. Robinson, CE. After election as an associate member of the Institution of Civil Engineers, in 1880, he established his own engineering practice. He travelled to Western Australia in 1884 where he prepared plans for the Midland Railway from Midland Junction to Walkaway, in conjunction with surveyors, Morrison and Crossland. In 1886 he formed a consulting engineering partnership with James Barrett with whom he prepared plans for a water supply for Perth and Fremantle from a dam on Munday Brook in the Darling Ranges in 1887. Elected a councillor of the City of Perth in 1885, he advocated the construction of a water supply for Perth. Disagreement between the Perth and Fremantle councils delayed a decision on a scheme until 1889 when Perth City Council agreed to negotiate a contract with Neil McNeil and Co., a Melbourne contractor who proposed to use Saunders and Barrett's scheme which it had bought and amended. Saunders acted as agent for McNeil and supervised some of the early work. Following the discovery of the Yilgarn Goldfield in January 1888, Saunders was one of the first Western Australian businessmen to promote Western Australian mining companies on the London financial market. In 1888 he was manager of Imperial Western Australian Corp Ltd which was intended to identify new mines with good potential and to launch them with British money. In 1889 he was manager of Frasers GMG Co and of Hope's Hill GMS Ltd both of which had mines in the Yilgarn Goldfield. He floated the West Australian Goldfields Ltd in November 1893 and Lady Shenton GMS Ltd (NCGF Menzies) in January 1895 together with several other companies including the Finance Corporation of Western Australia Ltd, formed to obtain finance from the United Kingdom and Europe. The West Australian Goldfields, of which he was also a director and attorney, in the period 1894-98 was one of the most successful companies in forming and promoting Western Australian mining companies. In 1895 Saunders was attorney for Aurora Gold Reefs Development Co. Ltd (BAGF Carnage), Hampton's Purchase Syndicate (relating to Hampton Plains Estate mainly in CGF and ECGF) and Mawson's Reward Claim Ltd (DGF at Dundas). In 1897 he was attorney for North White Feather Consolidated GMS Ltd (NECGF Kanowna), Gold Lands Corporation Ltd and Yerilla Claims Ltd (NCGF). Also in 1897 he was chairman of the board of directors of Florence GMS Ltd (NCGF Menzies) and was its managing director until 1909 during which time it produced 8,800 fine oz. At that time he was also a director of Anglo-German Exploration Co. of WA Ltd, Mawson's Reward Claim Ltd, Mount Jackson GMS Ltd (YIGF Mt Jackson) and seven other mining companies. During the 1890s Saunders was colonial agent for Fraser & Chalmers, the Anglo-American mining machinery manufacturer, and also for Hayward Tyler & Co., supplier of pumps and gold recovery equipment. He had retired from most of his business activities by the end of the 1890s and lived in partial retirement at Henley Park, a large estate near Guildford. He also held pastoral leases at Leinster in the East Murchison. He was president of the Royal Agricultural Society in 1901.

Saunders served as a Perth City councillor for ten years until 1895. In 1893 he was elected mayor of Perth and served for two years in this office. He served as a JP and was a member of the Legislative Council representing the Metropolitan Province between July 1894 and May 1902. He was a Commonwealth Senator for Western Australia from May 1903 until December 1903, having been appointed to fill a casual vacancy in the first Commonwealth Parliament. He was again a State MLC for the Metropolitan Province from May 1918 until October 1919 which was shortly before his death.

GG 1888 pp.270, 373, 1889 pp.137, 295, 449, 469, 1890 pp.11, 12, 1897, p.345; Skinner 1897, 1903, 1909; JCMWA 1905; Battye 2, pp.248-49; John's p.151; Kimberly p.42; Black/Bolton p.174; Le Page pp.158-59, 274. Hunt p.6 et al; DWAE 4, p.1919. BDWA 4, p.2733

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**SCOTT**, Malcolm Balfour MAusIMM

(b.c.1866)

Scott trained as a locomotive driver on the South Australian Railways and worked for two years in ore treatment plants at Broken Hill. In 1896 he moved to Western Australia where he built and maintained gold ore treatment plants. He worked at the Great Fingall Consolidated Ltd (MGF Day Dawn) and as an engineer at other mines between 1904 and 1909 and was elected a member of the Australasian Institute of Mining Engineers in 1909. He was at Kalgurli GMs Ltd. between 1909 and 1919 and was with Electrolytic Zinc in Tasmania in 1920-21.

JCMWA 1908, 1919; ArcAusMM

**SEARS**, T.H.

In 1909-10 Sears was at Great Boulder Perseverance GM Co Ltd (ECGF Boulder) under Ernest Williams (q.v.) who was managing the mine for Hooper, Speak and Williams, the consultancy in which he was a partner. Sears then joined the mining consultants and mine managers, Bewick Moreing and Co., and worked at mines which the company managed on the eastern and northern goldfields. The first was White Feather Main Reefs (1906) Ltd which incorporated White Feather Reward Claim mine (both NECGF Kanowna). Both mines were in their last stages of operation and were worked by tributers. Sears managed the closure of both in 1911 and moved to Lancefield GM Co Ltd (MMGF) at Laverton working under Marriot and then Joice (q.v.). The mine had a large low grade deposit but arsenopyrite in its sulphide ore proved costly to process and the mine closed in 1913. He then moved to the Sons of Gwalia Ltd (MMGF Leonora) working under A. Wauchope (q.v.). 1915 was the last year before Western Australian mines were adversely affected by the war in terms of manpower shortages and cost rises. The Sons of Gwalia produced 60 thousand fine oz in that year which was almost exactly the same as the average for the previous ten years and was the fourth highest for any mine in Western Australia in that year and the highest for ones outside Kalgoorlie. Sears left the mine in 1916.

RH.BMC; RH.Kalg, stats

**SHALLCROSS**, Vincent Fairfield MIMM, MAusIMM, MIMMAmer (c.1868-1932)

Born and educated in England, Shallcross worked in South Africa in 1896, and in 1897 became the representative in Western Australia of the Australian Gold Recovery Company Ltd (Aust GRC) after the previous representative, Peter McIntyre (q.v.), became cyaniding superintendent for Lake View Consols Ltd (ECGF Boulder) in February 1897. Aust GRC had been formed in 1892 as a subsidiary of the Scottish company Cassel Gold Extracting Co., holders of the MacArthur-Forrest cyanide gold extraction patents, with the aim of promoting the cyanide process in Australia. However the Privy Council ruled in December 1900 that the MacArthur-Forrest patents were invalid in Western Australia. (The patents reached their expiry dates in 1902 and 1903, when cyanide process patent royalties around the world ceased). Shallcross then became manager of Aust GRC which became principally the agents for the import of Cassel-manufactured cyanide into Australia. The company was renamed Australian Mining and Gold Recovery Co. Ltd and Shallcross was its managing director in 1909. From 1900 to 1905 he was owner and manager of Fraser's South Extended (YIGF Southern Cross). He was a director of the Mines Development Syndicate Ltd, together with R. Hamilton, G. Mackinnon and H.A. Judd (all q.v.) from 1900 to 1904. He was also associated with the British and Foreign Development Syndicate in 1903-13, the Gold Industry of WA Ltd in 1910-13 and the Star Syndicate in 1916-18. Between 1908 and 1911 he made a number of expeditions to inspect mining prospects on behalf of Bewick Moreing and Co. From 1911 to 1917 he was manager of Bullrush Gold Estates NL (YaGF) at Yuin.

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He was elected a member of the Institute of Mining and Metallurgy of America in 1899, of the Institution of Mining and Metallurgy in London in 1902, and of the Australasian Institute of Mining Engineers in 1908. He was a member of the executive council of the Chamber of Mines of WA in 1904-07 and represented the employers on the Conciliation Board of the Eastern Industrial District in 1902. Shallcross retired to pastoral pursuits in 1917 and became a partner in Rob Roy station near Meekatharra. His published papers include 'The profitable treatment of low grade propositions in Western Australia: Fraser's Mine at Southern Cross' *JCMWA* 1, 1902, pp.66-67.

*JCMWA* 1902, 1918; *TIMM* 43, 1933; Gibney/Smith 2, p.251. ArcAusMM

**SHAW**, Campbell MAusIME, JP. (b.1854)

Born at Greenock in Scotland, Shaw moved to Victoria with his parents and was educated in Ballarat. He joined the mining industry in c.1874 and during five years in the Ballarat district he managed two mines. After two years in New Zealand, he moved to New South Wales where for sixteen years he managed a number of gold, tin and silver-lead mines at Vegetable Creek, Newstead and Inverell. He moved to Western Australia in 1898 and prospected for two years in the Mount Margaret GF before accepting the manager's position at Golden Rhine GMs Ltd at Laverton (MMGF) and subsequently of Fraser's South Extension GM Co Ltd at Southern Cross (YIGF) in 1902-04. He then managed Ida H GM Co (MMGF) at Laverton from 1904 until 1913. During this time the mine had an average annual production of 9,500 fine oz of gold and paid £72,000 in dividends (having a nominal capital of £60,000). Shaw was manager of Central and West Boulder GMs Ltd (ECGF Boulder) in 1913-16 and of Great Boulder No1. Ltd (ECGF Boulder) in 1917-20. He gave evidence to the Royal Commission on Ventilation and Sanitation in Mines in 1905. He was chairman of the Laverton local committee of the Western Australian Chamber of Mines in 1907-10 and a member of the executive committee of the Chamber in 1915-20. He was elected a member of the Australasian Institute of Mining Engineers in 1909. For a lengthy period he was chairman of the Mount Margaret Roads Board and was appointed a JP in 1900.

Skinner 1899, 1903, 1904, 1909, 1915, 1920; *JCMWA* 1904, 1920; *WAMBEJ* 15 April 1905 p.11; Battye 2, pp.358-59; M.K. Quartermaine, pers. com. 1990. ArcAusMM

**SHIPMAN**, Hervey A.

An American who studied at Colorado School of Mines, Shipman was recruited by Herbert C. Hoover to work in Western Australia for the British company, Bewick Moreing & Co., mining consultants and mine managers. Hoover was the partner in the company responsible for operating the mines which the company managed. Shipman arrived in Western Australia in December 1902 and was appointed manager of Cosmopolitan Pty Ltd (NCGF) at Kookynie for 1903 and 1904. In the latter year the mine had the lowest working costs (excluding development work) of the 18 mines which Bewick Moreing managed in WA. In 1904, Bewick Moreing, in a rash move, agreed to take over the management of Golden Horse-shoe Estates Co. Ltd (ECGF Boulder) which was the largest gold producer in the state – 223 thousand bullion ounces or 195 thousand fine ounces in 1903 – and had been the second mine in the state to exceed 200 thousand bullion oz in one year. The mine, however, had very large working costs compared with other large WA producers. The management take over was subject to Bewick Moreing reducing the mine's working costs by 40 per cent by the end of 1904, a huge task requiring the full cooperation of the incumbent manager which was not forthcoming. The manager, J.A. Sutherland (q.v.), left for London at the end of April 1904 to persuade the directors to cancel Bewick Moreing's contract which they did on 17 September. After Sutherland's departure Shipman was made manager and set about reducing costs but, following Bewick Moreing's dismissal, he was moved from the Golden Horse-shoe to become manager of Lake View Consols Ltd. After the collapse in Lake View's production induced by Whitaker Wright, following its 1899 peak production of 236 thousand bullion

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oz, the mine was being conservatively managed with an average annual production of 45 thousand fine oz. The following year, 1905, Shipman was moved to manage Oroya-Brownhill Co. Ltd (ECGF Boulder/Kalgoorlie) which had been formed in 1902 by the amalgamation of Hannan's Brownhill GMg Co and Hannan's Oroya GMg (WA). Oroya Brownhill's peak annual production of 155 thousand fine oz coincided with Shipman's term at the mine. He left Kalgoorlie in the same year and became superintendent of the Independence mine at Victor, Colorado, which was one of the largest producers in the USA.

Skinner 1904, 1905; JCMWA 1904, 1905; pers. comm. Prof. A. Limbaugh Feb. 1999; Reid p.281

**SIMPSON**, Edward Sydney BE, DSc, FCS. (1875-1939)

Simpson was born in Sydney and attended the University of Sydney from which he graduated, with a BE degree in mining and metallurgy, in 1895. He worked for two years as a research chemist and assayer before being appointed Government Mineralogist and Assayer and Chief Chemist to the Western Australian Mines Department at the young age of 22. He was also responsible for the Geological Survey Laboratory. When the University of Western Australia began teaching in 1913 he enrolled for the BSc course in geology, graduating in 1914 with first class honours. In 1917 he applied for entry into the university's Doctor of Science programme and was awarded a doctorate in 1919 for his thesis, 'The minerals of Western Australia'. He pioneered the use of laboratory techniques in the identification of minerals and was the first mineralogist from Western Australia to gain an international reputation. He was a member of the Advisory Board of the University of Western Australia between 1902 and 1915, and a member of the Western Australian Munitions Committee from 1914 to 1919. In 1922, in addition to his position as Government Mineralogist he was appointed Government Analyst. He was responsible for combining the laboratories of the Government Analyst with those of the Geological Survey to form the Government Chemical Laboratories which he divided into three specialist sections, a structure which remained in place for nearly 20 years. Simpson was twice President of the Royal Society of Western Australia and was a member of the Senate of the University of Western Australia from 1920 to 1929. The mineral 'simpsonite' was named in his honour. He died in 1939 while he was preparing a monograph based on his doctoral thesis. It was edited by a colleague and published posthumously as *The Minerals of Western Australia* and is regarded as a scientific classic. In 1932 he published a comprehensive handbook *A key to mineral groups, species and varieties*. He produced numerous publications which include:

'Problems of water supply in Western Australia' *Proc ANZAAS*, Perth, 1926; and 'Contributions to mineralogy in Western Australia' *JHSA* 12-16, 1927-30.

Battye 1, p.460; WWA 1938 pp.460-61; ADB 11, pp.610-11; Glover/Bevan pp.111-14; Spillman pp.136-37, 169-70

**SIMPSON**, William Evans ARSM

A graduate of the Royal School of Mines, Simpson worked at Western Australian mines from 1895. After joining Bewick Moreing & Co., mining consultants and mine managers, in 1904 he was appointed manager of Great Boulder Main Reef Ltd (ECGF Boulder). The mine had the distinction of developing the first successful 'dry crush and roast' process for treating Kalgoorlie's sulpho-telluride ore but the discovery that its reserves were limited appeared to make its future questionable. (It closed in 1909.) In 1904-05 Simpson was manager of Oroya Brownhill Co. Ltd (ECGF Kalgoorlie) which had been formed in 1902 by an amalgamation of Hannan's Brownhill and Hannan's Oroya. In 1905 the mine produced 155 thousand fine oz which was the mine's peak annual production and the third largest amount produced by any mine in that year, the two mines with higher totals both producing 160 thousand fine oz. In the previous year Oroya Brownhill had been the fourth

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mine in the state to exceed 150 thousand fine oz in one year. Towards the end of 1905 Simpson was transferred to Lake View Consols Ltd (ECGF Boulder). The former policy of forced production of the mine's high grade ore under Whitaker Wright in 1899 had collapsed in 1900 and production in 1905 was almost the same as the average production for the decade from 1903. Simpson gave evidence to the Royal Commission on Ventilation and Sanitation in Mines in 1905. He left Bewick Moreing in 1906 apparently after a disagreement with the state manager W.S. Loring.

JCMWA 1905, 1906; RH. Kalg, tb 4

**SLEEMAN**, Herbert Richard MIMM, MIMMAmer

(c.1872-1956)

Sleeman was an apprentice with the Victorian Railways and studied at the Ballarat School of Mines. He worked in the mining industries of South Africa (1896-99), Rhodesia (1899), Nigeria (1901), the Gold Coast (1903), and Egypt (1904). From 1907 to 1914 he was manager of the Whim Well Copper Ms Ltd which mined the Whim Creek copper mine, 70 km east of Roebourne in the West Pilbara GF. The mine has been the largest single producer of copper in Western Australia. Its peak period of production was during Sleeman's management, from 1909 to 1914, when an annual average output of 9,500 t of ore was attained. This was facilitated by the construction of a 22km long tramline to a jetty at Balla Balla. Ore dressing was confined to hand picking and the use of breakers, screens and shaking tables until 1911 when a Murex magnetic separator was introduced which removed the ore particles preferentially but only operated until 1912. After 1914 Sleeman went into private practice dealing mainly with copper and gold mining in the West Pilbara. In 1919 Whim Well Copper Ms was reconstructed as Pilbara Copper Fields Ltd and Sleeman was appointed its consulting engineer. This company trialed several leaching processes but these were hindered by the lack of an adequate water supply. Sleeman was elected a member of the Institute of Mining and Metallurgy of America in 1905. He was in Perth in the 1940s.

His published papers include: 'An Egyptian gold mine' *TIMM* 14, 1904-05, p.482 & attachment; 'The detailed mapping of stoping areas' *TIMM* 15, 1905-06, pp.326-32; 'The Whim Well Copper Mine, West Pilbara, North-West Australia' *TIMM* 21, 1911-12, pp.210-28; 'Whim Well Copper Mine' *MER* Jan 1912, p.168; 'The relation of gold to currency' *E&MJ*, 18 Nov 1922; 'A resume of copper leaching in Australia' *E&MJ*, 4 Aug 1923; 'Treating Pilbara copper ore' *E&MJ*, 14 Feb 1925; 'Depression in Australian mining' *E&MJ*, 8 Oct 1925.

GG 1907, p.1315; *WAMBEJ* 1 Jun 1907 p.7, 23 Jan 1909 p.11, 31 Jul 1909 p.10, 6 Jun 1914 p.5; *JCMWA* 1908, 1920; *MER* Jan 1912, p.168; Skinner 1915, 1920; *RDM* 1926 p.144; *CMWA* 1957

**SPENCE**, S.

Spence was a mining technologist employed by Bewick Moreing & Co., mining consultants and mine managers, at mines which the company managed in WA. He was initially employed for two years (1906-08) at the Sons of Gwalia Ltd (MMGF) near Leonora and represented the mine on the Chamber of Mines. During the two years he was there the mine produced an average of 56 thousand fine oz of gold which was near its average annual production for the decade of 61 thousand fine oz. For a few months of 1908 Spence worked as a mining prospect inspection engineer for Bewick Moreing's agency company, London and Western Australia Exploration Co. Ltd, before returning to the Sons of Gwalia for another fifteen months. In October 1909, Spence moved to Kanowna to become manager of White Feather Main Reefs (1906) Ltd. (NECGF). The mine had been the main producer in Kanowna at the turn of the century with production peaking at 12 thousand fine ounces in 1902. Bewick Moreing had taken over the management in 1904 and despite a reconstruction in 1906 production did not revive and Spence closed the mine in 1910.

*JCMWA* 1906-10; DM stats, RH.BMC

## WESTRALIAN FOUNDERS OF 20<sup>TH</sup> CENTURY MINING

**SPENCER COMPTON**, George MBE, BSc, AWASM, MAusIMM (1891-1971)

Born in Southern Cross where his father, A.M. Compton, was a mining registrar, Spencer Compton, the name by which he became known, studied at Perth Technical College and graduated from the WA School of Mines with a diploma in metallurgy and an assayer's certificate in 1910. He worked at Oroya Black Range Ltd at Sandstone (EMGF Black Range), Yuanmi Gold Mines Ltd (EMGF Black Range) at Youanmi, Phillips River Gold & Copper Co. Ltd (DGF Ravensthorpe) and Princess Royal Gold Mine Co. (DGF Norseman). After four months at the Beria Consols (MMGF Mount Margaret) at Laverton, he joined the Ida H. GMg Co. Ltd (MMGF Laverton) in 1915. After service in the AIF in Egypt and in France between 1915 and 1918, he spent one year as an assistant chemist in the Geological Survey of WA, and joined the Perth Technical College as a lecturer in metallurgical subjects in 1919. He was awarded a BSc degree at the University of Western Australia and undertook postgraduate studies. He joined the staff of the Western Australian School of Mines at Kalgoorlie in 1934. While at the WASM he acted as consultant to two mines in the Menzies district. The first, Lady Shenton GM (1934) NL (NCGF Menzies), reopened the successful pre-1914 mine Lady Shenton and produced 13,277 fine oz in six years with a yield of 10dwt per ton. The second First Hit (NCGF Davyhurst) was a failure and closed within a year. Spencer Compton was also seconded by the Government to manage Spargo's Reward Mine to the south of Coolgardie. He served in the AIF from 1940 to 1945 and retired from the WASM after the war.

His published papers include: 'Telluride discovery', *JHSWA* Vol. 3, Dec 1947, pp.50-52;

'Yilgarn and Coolgardie Railways', *JHSWA* Vol.5, Part 2 1956, pp.29-33;

'Telluride minerals on the Golden Mile – Discovery in 1896', *CIMR* Jan 1957, pp.33-34;

'Early history of Western Australian goldfields' *CEMR* June 1957, pp.51-56;

*Old Kanowna: Eastern Goldfields Series 7*, Kalgoorlie, August 1958;

'Mining engineering in Western Australia' *MCER* Oct 1958, pp.58-62;

'The Edwards Furnace: introduced into Western Australia sixty years ago' *MCER* 15 Aug 1960, pp.74-78;

'The South Kalgurli, a glamour company of the Golden Mile' *MCER* 15 Sept 1961, p.57;

'Block 45; first lease of Golden Mile, registered 4 July 1893, seventy years ago', *JHSWA*, 1963, p.48.

RDM 1915, 1934, 1945; *MCER* Dec 1937, p.107; *MYBA* 1940 p.162; *ArcAusMM*

**STAFFORD**, Charles S.

In 1897 Stafford was managing director in London of Kalgurli GMs Ltd (ECGF Kalgoorlie). The company was registered in 1895 and held two leases in the centre of the Golden Mile (to the north of Great Boulder Perseverance). The mine produced its first gold in 1897 and began regular annual production totals in excess of 30 thousand fine ounces in 1902. Production peaked in 1906 at 91 thousand fine oz. which was the sixth highest by a WA mine that year. Regular dividends were paid. The chief executive became the general manager in Western Australia but Stafford remained a director. In 1897 Stafford was also the consulting engineer for Hainault GM Ltd (ECGF Kalgoorlie) whose lease adjoined the western side of Kalgurli GMs. (At one time both mines had the same manager). Unlike most mining companies in WA which were formed in the UK, Hainault GM was registered in Edinburgh rather than London and had its office in Glasgow. Stafford moved to Western Australia to become the local manager of the Hainault mine in 1898-99. During this period the mine was still doing preparatory work, its first gold being produced in 1901. From 1905 until 1914 when the mine was amalgamated with South Kalgurli GMs Ltd, Hainault produced an annual average of 19 thousand fine ounces and paid regular dividends. In 1898, in Kalgoorlie, Stafford was also manager of Ironsides North GMg Co. (ECGF Kalgoorlie) whose lease was on the north-western side of the Golden Mile (see Fig.3). The company had been formed in Adelaide in 1897 and produced its first gold

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in 1901 but the mine was not successful, closing in 1909, having produced only 3.5 thousand fine ounces. Its lease was taken over by a second company, Ironsides North Leases which, surprisingly, produced 128 thousand fine oz. in 12 years from only 72 thousand tons of ore. In 1899 Stafford was also manager of Britannia GM Co. Ltd (NCGF Kookynie) which in the years 1898-03 produced 9.1 thousand fine oz. from 7.9 thousand tons of ore.

Skinner 1897, 1899, 1900

### **STEVENS**, Thomas Branbrook MIMM

Stevens was a senior metallurgist employed for nearly twenty years by Bewick Moreing & Co, mining consultants and mine managers, at mines managed by the company. In 1906 and 1907 Stevens was at Lake View Consols Ltd (ECGF Boulder) during a period of rapid cost reduction and capacity expansion by the treatment plants of most of the large mines on the Golden Mile. Lake View Consols retained large tailings heaps of slimes from its wet bromo-cyanide sulphide treatment valued at 2-4 dwt per ton which could not be profitably re-treated by the main plant. After much experimentation Stevens and W.R. Degenhardt (q.v.) devised the first 'fixed immersed vacuum-filtration' (or basket-filter) plant in Kalgoorlie to treat the slime residues. In 1907 the first small (400 tons per day) plant commenced operation treating 17,745 tons of slimes in its first year for a £2,497 profit. The plant was similar in principle to an American basket-filter plant but differed in operation. In the following year a larger improved plant was installed at Bewick Moreing's other large mine on the Golden Mile, Oroya Brownhill Co Ltd (ECGF Kalgoorlie-Boulder). The gold content in the Oroya tailings was 2 dwt per ton but the gold recovered was worth twice the cost of recovery. With the residues treatment plants in operation, in 1908 Stevens moved to Vivien GM Co Ltd (EMGF) at Harris near Lawlers.

The mine was producing over 10 thousand fine ounces of gold per year with a yield of 7 dwt per ton which was decreasing rapidly. The mine closed in 1910 and Stevens returned to Kalgoorlie where Oroya Brownhill amalgamated with Golden Links Ltd and Kalgoorlie Amalgamated (New) Ltd to form Oroya Links Ltd and the steady fall in production of the eastern leases was stabilised at 40 thousand fine oz until 1915. Stevens was at the Sons of Gwalia (MMGF Leonora) from 1913 to 1925. In January 1921 a serious fire in the mine's surface workings destroyed most of the plant and the powerhouse. The slimes treatment plant and the accumulated tailings of sands and slimes were saved and Stevens mobilised treatment of the slimes using a new vacuum filtration plant. For two years gold from the plant was the only source of income for the mine and over seven years more than 700,000 tons of sands and slimes were reprocessed. Stevens left the Sons of Gwalia in 1924 and gave evidence to the Royal Commission on Mining in 1925. During the 1930s he was a consulting metallurgist in London to the Lake View and Star Ltd (ECGF Boulder) for works which included the large-scale re-treatment of the accumulated cyanide tailings from the Golden Horseshoe mine (which had been taken over by Lake View and Star) using powerful sluicing equipment and Oliver vacuum filtration equipment. Stevens wrote extensively on the technical aspects of his work. His published papers include:

'The estimation of the capacity of vacuum filter plants' *JCMWA* 8, 1909, pp.326-28;

'The metallurgy of the Sons of Gwalia Mine ore' *JCMWA* 14, 1915, pp.211-27;

'The effects of mineralised water in cyanide plants' *TIMM* 24, 1915-16, pp.372-86;

'Recent improvements in vacuum filtration plants' *JCMWA* 15, 1916, pp.291-96;

'The effect of the cost of water on metallurgical progress at Kalgoorlie' *JCMWA* 16, 1917, pp.189-90;

'The supply of lead salts for use in cyanide plants' *JCMWA* 17, 1918, pp.117-18;

'Ore treatment at the Lake View and Star' *MMg* Oct 1933;

'The treatment of cyanide tailings from the Golden Horseshoe Mine' *TIMM* 45, 1935-36, pp.475-502.

(with W.R. Degenhardt) 'The vacuum filter press in Western Australia' *JCMWA* 10, 1911, pp.12-23; and



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'Description of the re-treatment plant and process of the Oroya Brownhill Co.' *JCMWA* 10, 1911, pp.60-68;  
(with W.S. Bradley) 'Effect of mineralised waters in cyanide plants' *TIMM* 24, 1914-15, pp.372-85;  
(with C.E. Blackett) 'Use of haloid cyanides for the purpose of gold extraction' *TIMM* 29, 1919-20, pp.280-97, 313-19.  
*JCMWA* 1908, 1920; 'RRC Mining' V&P WA 1925, 3; *MYBA* 1940; RH.Kalg.cp 6.4

**STEWART**, Hector MLC, MCE, MAusIMM, AMIEAust. (1875-1931)

Born at Windsor in Victoria, Stewart was educated at Wesley College, Ballarat School of Mines and Melbourne University from which he graduated with a degree in mining engineering. He commenced his mining career in 1894 by working at Long Tunnel Mg Co. at Walhalla and then in South Africa in the Transvaal mining industry. He returned to Victoria in 1896 where he was manager of an ore treatment plant. He upgraded his mining degree by thesis in 1898 to a Masters degree in civil engineering. By 1898 he had moved to Tasmania where he was appointed assayer and assistant engineer at the Lyell Tharsis Mg Co. Mining activities at Mt Lyell were then in the boom period with forty mining companies working in the district. In 1899 the Lyell Tharsis Mg Co. became the second company on the minefield to pay a dividend as it supplied siliceous ore for the copper smelters of Mt Lyell Mg Co. Stewart visited Western Australia in 1898 and moved there in the following year. He married in Victoria in 1900 and moved to Britain to do postgraduate studies into economic geology at Glasgow University (1901). He returned to Western Australia where he commenced practice as a consulting engineer and arbitrator. He also purchased a wool-growing property at Wagin which he upgraded to a merino stud after 1924. In 1916 he was the Commissioner appointed by the WA Government to enquire into coal mining at Collie. In the following year following a by-election he became a Country Party Member of the Legislative Council representing South-East Province, a seat which he held until 1931. In 1930 he was a member of the parliamentary enquiry into the Main Roads Act. Shortly afterwards he retired from his engineering practice. He was elected a member of the Australasian Institute of Mining Engineers in 1902 and was a foundation member of the Institution of Engineers, Australia in 1919. He was the chairman of directors of Primary Newspapers Co and was active in the establishment of Wagin Farmers Co-operative Co.

'RC Collie Coal Industry' V&P WA 1916-17; *MER* Jan 1918, p.126; *FJA* 1927-28, p.242; *WAust* 10 Aug 1931; 'Obit' *JIEAust* 5, 1933, p.33; *ArcAusMM*; Black/Bolton 2, p.186; Blainey. Lyell pp.138-39

**STOKES**, Charles Hartley ASASM, MAusIMM (b.c.1879)

After graduating from the South Australian School of Mines, Stokes moved to Western Australia in ca. 1902 where he worked as a mining surveyor. He was elected a member of the Australasian Institute of Mining Engineers in 1910. He was employed by Bewick Moreing and Co., mining consultants and mine managers, and worked at South Kalgurli GMs Ltd (ECGF Boulder) which, from 1912, he represented on the WA Chamber of Mines. For the previous seven years the mine had produced an average of 34 thousand ounces of fine gold, making the mine the tenth highest producer in the state. It had, however, rapidly diminishing reserves and in 1914 it was amalgamated with its neighbour, Hainault GM Ltd (ECGF Boulder) which had larger reserves but a less adequate treatment plant. The new company South Kalgurli Consolidated Ltd continued to produce an average annual product of over 30 thousand fine ounces for another decade. Stokes left the mine in 1919. He was in Newcastle in 1920-21, and in Perth in 1923. He was a Trustee of the Institute of Mine Surveyors in 1914.

*JCMWA* 1913-1919; RH.Kalg. tb 4 *ArcAusMM*

**STUCKEY**, Norman S.

Stuckey was manager of Greenfinch Pty GM (YLGF) at Westonia in 1914-15 and represented it on the WA Chamber of Mines. The Westonia mining district, of only 17 sq.km, had seven mines each of which produced more than one thousand

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ounces of gold. By far the most successful was the Edna May GM Co. which produced 171 thousand fine oz. (1913-20). In its early years it was very rich, producing in 1916, its peak year, 39 thousand oz from 37 thousand tons of ore. The company battled against a serious ground water problem which eventually forced it to close in 1920. A second company, managed by Stuckey (in 1918-20), which had a new method of controlling the ground water, took over the lease and produced 38 thousand oz of fine gold from 47 thousand tons of ore. The mine reached 24 metres underground before the water could no longer be controlled. Stuckey gave a paper to the AusIMM on the water control method used at the Edna May mine: 'Some notes on the Westonia goldfield with special reference to the new method of controlling underground water adopted in the Edna May Deep Levels Gold Mine' *PAIMM* 28, 1917, p.27. His other published papers include 'The cementation process' *JCMWA* 18, 1919, pp.31-3. He was a director and the consulting engineer to Australian Blue Asbestos in 1940.

*WAMBEJ* 23 June 1916, p.5; *JCMWA* 1918, 1920; *MYBA* 1940; *De Havelland* 1, p.240.

### **SULMAN,** Henry Livingstone FIC, MIMM

Sulman was educated at University College, London, where he was a medalist in practical and theoretical chemistry. From 1881 to 1892 he was a chemist and manager of a number of technical works manufacturing soap, alkali, and other commercial and fine chemicals in Bristol and London. From 1893 to 1897 he was in professional practice with E.E. Berry and then R.T. Marshall as assayers and metallurgists and then was in partnership with Hugh K. Picard as metallurgists. In 1892-93 Sulman and F.L. Teed led an investigation into possible improvements to the cyanide process carried out by a group of leading British metallurgists which included C.T.J. Vautin and H.F.K. Picard. One of the patented findings, known as the Sulman Teed process, involved the addition of bromocyanide after potassium cyanide in the cyanide process which made cyanide a far more rapid solvent of gold and also made the process effective on a number of previously untreatable ores. With the help of Bewick Moreing & Co., the mining consultants, the metallurgists, in December 1894, formed a public company, Gold Ore Treatment Company, which acquired the Sulman Teed patent and three others discovered by the syndicate. In 1895 they formed another company Gold Ore Treatment Co. of Western Australia which acquired the rights to the Western Australian patents for the Sulman Teed patent. A demonstration of the effectiveness of the process on the treatment of tailings was organised in 1896 at Consolidated Murchison GMs (MGF) at Day Dawn near Cue. The results of the trial were very good with tailings assaying 4 dwt 7 grains being reduced to residues of only 12 grains per ton. Subsequently only one other mine in Western Australia, Bayley's United GMs at Coolgardie, adopted the process as in 1896 at the height of the boom the finer points of tailings treatment were overlooked in the rush to float scores of Westralian gold mining companies. German metallurgists had also shown interest in the use of bromocyanide, one of whom, Carl Gopner, was an original shareholder in the Anglo-Continental Gold Syndicate formed by Edmund Davis in January 1895. This company made an agreement with Hannan's Brownhill GMGCo. (ECGF Kalgoorlie) in November 1896 to provide the mine with an ore crushing and dressing plant in return for shares in the company. The Syndicate formed a company, London and Hamburg Gold Recovery, whose chief chemist, Ludwig Diehl (q.v.) supervised the construction of the plant which took over a year to complete and was not commissioned until October 1898. The most significant aspect of the new plant for oxidised ore was that the fine sands and slimes were cyanided with both potassium cyanide and bromocyanide, the only plant on the Golden Mile to use bromocyanide for oxidised ore treatment. Sulman and Teed received no royalties for the bromocyanide use, however, because Gold Ore Treatment Co. of WA had been taken over by London and Hamburg Gold Recovery Co. including all the shares held by Sulman and his fellow metallurgists. Meanwhile Diehl was developing what became known as the Diehl process for the treatment of the Golden Mile sulpho-telluride ores using bromocyanide treatment of the slimes from which Edmund Davis and his German colleagues expected to receive extensive royalties.

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Sulman and Picard were both founding directors of Minerals Separation Ltd, a company formed by John Ballot in 1903 to develop the separation of minerals by flotation or similar means. The company set up a laboratory in England and an experimental plant on the Sulphide Corporation lease at Broken Hill in June 1905 to develop the Cattermole process. In this process oil was mixed with crushed ore causing heavier sulphide particles to coalesce and sink. At both plants investigators showed that small amounts of several oils and acids could produce froths to float sulphides and this discovery was patented by Ballot, Sulman and Picard and became the basis of Mineral Separation's successful flotation process. Much of its development continued in Australia for the next ten years while in Britain Sulman and Picard acted as the company's technical directors while W. Broadbridge (q.v.) was chief engineer, G.A. Chapman the metallurgist and T.L. Hoover the general manager (until 1910). By 1913 the technology that the company had developed was superior to that of other companies and its aims changed from developing the flotation process, selling it to other mines and using it on its own mines to concentrating on selling the process and using royalties as the source of profits. It has been claimed that the flotation process stands with the cyanide process and the Bessemer process as the three greatest advances in metallurgy in the last thousand years. Sulman was a founding member of the Institution of Mining and Metallurgy and was its President in 1910-11.

Sulman's papers include: 'Improvements in gold extraction', *TIMM* 3 (1894-95), pp.202-33, 236-37, 254-62; 'Dry process for the treatment of complex sulphide ores', *TIMM* 10 (1901-02), pp.430-42; Presidential address (developments in metallurgy), *TIMM* 20 (1910-11); 'A contribution to the study of flotation', *TIMM* 29 (1919-20)

Safford 1908, p.89; RH.Kalg ch 5.2; Birrell 7.

**SUTHERLAND**, John Waters ABalSM, MAmerIME, MAusIMM (c.1870-1946)

Sutherland was born in Ballarat and was a graduate of the Ballarat School of Mines. In 1889 he became assayer and chemist at a mine in Broken Hill and in 1893 the mine's assistant metallurgist. He was appointed metallurgist at Lake View Consols Ltd (ECGF Boulder) under H.C. Callahan (q.v.) in 1896 and shortly afterwards was involved in the introduction of filter presses in the cyaniding of slimes. They were first used to treat Kalgoorlie ores in Hamburg in 1896 when a German Deyne filter press (from the sugar beet industry) was used in the treatment of ore from Hannan's Brownhill GMg Co Ltd (ECGF Boulder). When the managers of Hannan's Brownhill, Bewick Moreing & Co., wished to repeat the trials at the mine it ordered a similar press to Deyne's from S.H. Johnson & Co., the British manufacturer of filter presses for the sewage treatment industry. This was set up during the reconstruction of Brownhill's first oxidised ore mill in early 1897 and was claimed to be the first operational filter press in Kalgoorlie. Meanwhile in January 1897 Sutherland and Peter McIntyre (q.v.), manager of Australian Gold Recovery Co. (AGRC), the holders of the MacArthur-Forrest cyanide process patents, were reported to be working together on the development of the Lake View Consols cyanide plant, it then being the usual policy of AGRC to assist in the development of new cyanide plants. At the end of February it was announced that filter presses were to be used on slimes and that one had been ordered. In August the prototype Deyne filter press was set up and in the following month Richard Hamilton of Great Boulder advised a colleague that it was working 'like a charm'. During 1897 Sutherland was also examining possible ways of making the cyanide process more effective on the mine's sulpho-telluride ore and in particular by roasting the ore to obtain products from which gold could be extracted more easily. Accordingly in that year he set up a small Victorian reverberatory furnace which was the first on the Golden Mile specifically designed as a pilot plant for roasting sulphides. The results of the roasting tests were sufficiently favourable for Callahan to recommend the construction of a sulphide plant based on dry crushing and roasting which was built in 1899. However, in August of that year Sutherland was appointed manager of Golden Horse-shoe Estates Co. Ltd (ECGF Boulder). In 1897 Charles Kaufman (q.v.), the controversial financier, had gained control of the previous company, Golden Horse Shoe GMg

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Co, and in 1899 the new company took over. In addition to Sutherland, George Klug (q.v.) was recruited as the company's metallurgist. The most important policy to be decided was how to process the two grades of sulphide ore being opened up. Initially the plan was to send high grade ore and concentrates to smelters and to roast ordinary sulphide ore. The company abandoned the idea of roasting ordinary sulphide ore and Kaufman formed a new company, Fremantle Smelting Works Ltd in March 1900, to operate a smelter at Fremantle which would smelt standard sulphide ore and concentrates. A small smelter would be built at the mine to smelt the high grade sulpho-telluride ore. The small three stage smelter, designed by Sutherland and Klug, commenced operation at the mine in 1901. It was the most advanced processing plant yet built on the Golden Mile and consisted of a water-jacketed blast furnace producing bullion which was refined by two cupellation furnaces which were followed by a Miller's chlorination plant to remove the silver. In the first two years over 50 thousand bullion oz were produced at average grades of 237 dwt per ton (1901) and 320 dwt per ton (1902). During 1903 the amount of high grade ore began to diminish and when the mine's sulphide plant was opened the small smelter was closed. Sutherland was appointed general manager of Fremantle Smelting Works which took over an existing smelter. Sutherland supervised its start-up in August 1900 and its early operation but by mid-1901 Klug had taken over from Sutherland who returned to the mine. Klug remained in charge until July 1902 when the company went into liquidation. Its failure was probably due to technical problems rather than any shortage of customers. Another smelting company, Fremantle Smelter Ltd, also associated with Kaufman, was formed in February 1903. Klug was made general manager and a completely new smelter to his design was built at South Fremantle and commenced operation in November 1903. However, in the 13 months from July 1902 to November 1903 when no smelting was done at Fremantle all the major Kalgoorlie mines including the Golden Horse-shoe had opened sulphide ore treatment plants or had found alternative methods of treatment so the use of the Fremantle works was changed to the smelting of copper and lead ores. Because the Golden Horse-shoe had sent its ordinary sulphide ore to Fremantle for smelting (both mine and smelter having common directors) the company delayed building a plant to process all its sulphide ore until 1901 when Sutherland built No. 1 sulphide Mill by converting the oxidised ore mill (with a 50 head battery). Instead of using one of the two proven methods of treating sulpho-telluride ore, the 'dry crush and roast' process or the Diehl process which utilised bromocyanide as well as cyanide, the Golden Horse-shoe (like its neighbour Ivanhoe Gold Corporation) adopted a third method by using an extension of the traditional wet stamp-mill practice until the amount of gold left in the tailings became unacceptably high when bromo-cyanide treatment of the slimes would be added as long as provision of the bromocyanide cost less than the value of the gold saved. (At the Golden Horse-shoe bromocyanide was not used until 1914) No.1 Mill was opened in April 1902 followed later in the year by the first half of No.2 Mill (with a 100 head battery). In 1903 the mine became the biggest gold producer in the state (195 thousand fine oz). Due to its use of the smelter the mine had a high extraction rate but at a high cost. The new policy of the mine was to lower costs by increased throughput, a dangerous policy if output could not be maintained. In February 1904, Bewick Moreing & Co., mining consultants and mine managers, signed a most unusual contract with the directors of the Golden Horse-shoe. Management of the mine would be transferred to Bewick Moreing if the company was able to reduce the mine's total costs from 46shillings a ton to less than 25s per ton by 31 December 1904 – more like a wager than a contract. The neighbouring mine, Ivanhoe G Corp for which Bewick Moreing was consultant, had total costs of 23s 6d per ton so 25s might seem possible but only if the directors and Sutherland were fully cooperative. It soon became apparent that this was not to be. Sutherland sailed for London to 'confer with the directors' and, no doubt, to do what he could to sabotage the new arrangements. By September the contract was cancelled and Sutherland returned in triumph to Kalgoorlie. Bewick Moreing completed the second stage of No.2 Mill but reported that the plant was 'grossly underpowered' and recommended the installation of a larger capacity engine which was refused by the board. Bewick Moreing hired the necessary engine which Sutherland later purchased. In 1908 he installed a 500 kW turbo-generator and transformer to

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power the plant, the mine thus becoming the first on the Golden Mile to largely convert to electrical power. At the end of 1909 the Golden Horse-shoe had been the largest gold producer in Kalgoorlie for ten years. It had paid £3 million in dividends and was raising 25 per cent more ore every year than any other Kalgoorlie mine. However, in January 1910, came the first sign that all was not well with the mine when the monthly gold return fell from 11,320 fine oz in December to 6,551 oz in January 1911 despite there being no decrease in the tonnage raised. This short term fall led to the exposure of what was to become more serious longer term falls in grades and production. This had not been foreseen because Sutherland, over a number of years, had been including in his estimates of reserves ore that had not been 'blocked out' on three sides and had given these inflated values which had not been fully corrected for when the ore had been stoped. In one year (1909-1910) gold production fell by 31 per cent from 143 thousand oz to 98 thousand oz. Production never exceeded 105 thousand oz again, averaging 96 thousand per year in 1910-18 and 53 thousand in 1919-25. Sutherland retired in 1928 when the Golden Horse-shoe closed, having produced over 2 million fine oz of gold from 4.8 million tons of ore.

Sutherland gave evidence to the Commonwealth enquiry into foreign contract labour in 1901, to the state Select Committee into amendments to the Friendly Societies Act in 1902 and to the Royal Commissions on miners' lung diseases in 1911 and on the mining industry in 1925. He was a local director of Triton Gold Mine (MGF Reedys) in 1940, and a director of Yellowdine Gold Development (YGF Mt Palmer) in 1940, and of the Lady Shenton GM (1934) (NCGF Menzies) in 1938. He was elected a member of the American Institute of Mining and Metallurgical Engineers in 1892, and of the Australasian Institute of Mining Engineers in 1909, and was President of the latter institute in 1918. He was a member of the executive committees of the Kalgoorlie Chamber of Mines 1898-1901 and of the Chamber of Mines of Western Australia from 1901. He was Vice-President of the latter between 1906 and 1929. In 1899 (with W. Techow) he applied for WA Patent 2483 'Improvements in the precipitation of precious metals ... zinc shavings'. He obtained a sealed WA patent for a 'rotary water sprayer for use in steam cooling towers and the like' in 1903 and also patented this invention in 4 other Australian states and in Great Britain, the USA and the Transvaal Republic.

GG 1899, p.1777; Skinner 1900; JCMWA 1902, 1929; RH.Kalg cps 2.3, 3.3, 4.2, 5.4, 7.4; Clark pp.32, 51; 'RRC Mining industry' V&P WA 1925, 3; RH.BMC thesis cp 3; FJA p.168. WWA 1927, 1935. MYBA 1940. ArcAusMM; Reid pp.238, 279, 282

**SUTHERLAND**, William George ASASM, MIMM, MAusIMM (1865-1935)

Sutherland graduated from the South Australian School of Mines in Adelaide in 1897. Having moved to Western Australia he was appointed metallurgist at Golden Horse-shoe Estates Co. Ltd (ECGF Boulder) under manager J.W. Sutherland in 1899. He was the chemist at Lake View Consols Ltd. (ECGF Boulder) from 1903 to 1906 when he moved to a management position at the Fremantle smelter. In February 1902 a new company, Fremantle Smelter Ltd (FSL) was formed to take over the assets of Fremantle Smelting Works Ltd (FSML) which went into liquidation in July 1901. The FSML smelters which had been built to smelt the refractory Kalgoorlie sulpho-telluride ore were replaced by new smelters designed by the FSL general manager, G. Klug (q.v.), which commenced operation in November 1903. However, during the two years in which the smelters had been closed the majority of Kalgoorlie mines had begun to treat their sulpho-telluride ores by new processes at the mines and for a short time only one mine sent large quantities of concentrates and sulphide ores to the smelters. FSL operations were therefore reorientated to smelt lead from the three Northampton mines which had provided lead flux for the gold smelting. In 1906 Klug returned to Kalgoorlie and Sutherland was appointed FSL general manager and moved temporarily to Northampton to develop the mine at Baddera. The company's reorganisation proved costly and FSL went into liquidation in 1909. Its undertakings were taken over by Fremantle Trading Co. Ltd (FTCL) of which Sutherland became general manager. In 1914 the Commonwealth Government placed an embargo on the export from

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Australia of lead ore and concentrates but not of pig lead or refined lead. Lead mines were obliged to market concentrates locally or send ore to the smelters. Although a small scale operation by international standards FTCL was consistently profitable for ten years although its existence was critically dependant on lead prices in London. After peaking in 1918 the price fell by 17 per cent the following year and Sutherland announced the imminent closure of his company's operations. The lifting of the export embargo in 1920 coincided with an unexpected rapid rise in the lead price and Sutherland recommenced mining at Baddera and Narra Tarra. Baddera, which had been the state's largest lead producer, was soon worked out and closed in 1921. The output of the two remaining mines was insufficient to keep the smelters going and, in 1923, the mines and smelters closed down permanently.

Sutherland gave evidence to the Royal Commission on the ventilation and sanitation of mines in 1905. He was elected a member of the Australasian Institute of Mining Engineers in 1909 and of the Institution of Mining and Metallurgy in London in 1916. He was in London in 1934.

*JCMWA* 1907, 1920. Skinner 1899, 1902, 1903, 1914, 1915, 1920; *TIMM* 45, 1935-6, p.523; *ArcAusMM*; RH.Kalg, cp3; G. Kelly *JHSWA* vol.8, no.1, 1962; *MPR* Sept 1919, April 1920; *MPRBG* Dec 1921, Feb 1922; J. Blockley *MRB* 9, pp.15-17; R.C. Wilson, 'Northampton MF', DM,1926

## T

**TAYLOR**, Edgar Hogan ASASM, MIMM, MAusIMM (1878-1949)

Taylor graduated in 1896 from the South Australian School of Mines with a diploma in mining and metallurgy and then worked as a chemist at the Port Pirie smelter of the Broken Hill Pty Co. In 1901 he joined Great Boulder Perseverance GMg Co (ECGF Boulder) as metallurgist under manager R. Nichols (q.v.). In 1903 the mine's gold production peaked at 169 thousand fine oz, the second highest in the state that year. In 1904 Bewick Moreing & Co had an unsuccessful period of management of the mine which was aborted by the directors and Nichols. In 1905 G.C. Klug (q.v.) was appointed manager. Taylor was retained as treatment plant manager. Subsequently, in 1908, Taylor became acting manager. He left the company in 1909 to become superintendent of Lancefield GMg Co. (MMGF Laverton) when the company was struggling to operate its treatment plant for the mine's refractory ore. He moved in the same year to become manager of a new company which was attempting to revive Fraser's mine at Southern Cross (YIGF) but, in 1910, he left to become the general manager of a mining company in Sumatra. In 1914-17 he was at the Great Cobar Mine in NSW, and in 1921-23 was in Victoria. Between 1924 and 1938 he was general manager of Burma Corporation (India) which was mining the very large Bawdwin silver-lead deposits in north-eastern Burma. He was elected a member of the Australasian Institute of Mining Engineers in 1909. In 1906 he registered Commonwealth Patent 5703 for 'improvements to stamper batteries' which was renewed in 1913. His published papers include:

'Notes on the recovery of bullion from zinc-box sludge' *JCMWA* 2, 1903, pp.117-21;

'The production of bullion from zinc-box precipitates' *MBEJ* 16 March 1907, p.9;

with G.C. Klug (q.v.), 'Calculation of the relative efficiency of crushing and grinding machines' *JCMWA* 4, 1905, pp.944-98; also 5, 1906, pp.93-97, pp.273-84.

*JCMWA* 1907, 1910. *MBEJ* 13 Feb 1909, p.5; *MCER* Mar 1938 p.203, Dec 1949 p.105; *ArcAusMM*; Patent Register of W.G. Manners

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### **TAYLOR**, Howard W.

Taylor was a Kalgoorlie share broker, mine manager and attorney associated with T.F. Brimage (q.v.). He was a founding member of the Kalgoorlie Stock Exchange in August 1895, a member of the Kalgoorlie Chamber of Mines in 1896 and a member of the East Coolgardie Roads Board. He was attorney for Brownhill Mining Syndicate in 1898-99, Kalgurli Star in 1899 and Hannans Brown Hill North and Treasure Trove in 1900 (all ECGF). He represented Hannan's Bendigo Syndicate (ECGF) on the Chamber of Mines of Western Australia in 1902. He subsequently moved to England but participated in the promotion of the Celebration rush on Hampton Plains in 1920.

WArg 1 Aug 1895; WAGC 5 Oct 1896 p.17; GG 1899, p.1035; Skinner 1899, 1900; JCMWA 1902; Reid pp.198, 220

### **THOMAS**, Albert Ernest MICE, MIMM, MLA. (1872-c.1923)

Thomas was born in Barmouth, Wales, where his father was a mining engineer. He was educated in Truro and Sheffield and in 1892 graduated from the Camborne School of Mines where he won the Mining Institution Medal. He worked in the Transvaal Republic at the Ferrera GM in 1893 and at the Worcester GM in 1895. He moved to Western Australia in 1896 to become manager of the New Austral Company's mine at Broad Arrow (BAGF) which produced an average of 4.5 thousand fine oz per year. In 1900-02 he was manager of Norseman GMs Ltd (DGF) which produced an average of 6 thousand fine oz of gold per year. He returned to the New Austral Co. Ltd as manager in 1902-08, and was general manager of Vale of Coolgardie GM (CGF) at Bonnievale in 1899-1903, producing an average of 3.2 thousand oz per year. He was manager of Jourdie Hills GM (CGF Kunanalling) in 1904-5 (averaging 3.2 thousand oz per year), of Murchison Associated GMs Ltd at Day Dawn (MGF) in 1905-8 (averaging 508 oz per year), and of East Fingall GM Ltd. (MGF Day Dawn) in 1908 (155 oz per year average). Thomas was a member of the Executive Council of the Chamber of Mines of WA and was a member of the provisional committee of the WA School of Mines in 1902. He was elected a member of the Institution of Mining and Metallurgy (UK) in 1909. He was an Independent Member of the WA Legislative Assembly representing Dundas from April 1901 to October 1905. After 1910 he returned to live in Cornwall and was associated with mines in Cornwall and in Portugal.

JCMWA 1902, 1908; GG 1904 p.908; Skinner 1900, 1903, 1905, 1909, 1915; Black/Bolton 1, p.192

### **THOMPSON**, Robert Dunlop JP

Thompson was the manager of Mount Charlotte GM (ECGF Kalgoorlie) in 1895-7. He was a founder member of the Kalgoorlie Stock Exchange in August 1895 and was active in the formation of the Mine Managers Institute in 1897. He was appointed a Commissioner for the Royal Commission into Mining in August 1897. Thompson was the consulting engineer for Hannan's Gold Estates Ltd. (NCGF Kookynie) in 1897-99. He was voted chairman of the Kalgoorlie Roads Board after T.F. Brimage (q.v.) resigned in February 1900. Thompson moved to Victoria in December 1902.

WArg 26 Sept 1895, 4 Jan 1900; GG 1897 p.532; Reid pp. 198, 225, 252, 281; Skinner 1897, 1899, 1900

### **THOMPSON**, W. AMICE, MNEIMME

Born in the north of England, Thompson was indentured to J. Ramsay MNEIMME and studied at Newcastle University College. After two years of mining experience in England, South Africa, southern Russia, Germany, Austria and Hungary, he arrived in Australia in ca. 1885. After more than four years as Government Mineralogist in Queensland, he moved to Western Australia where he worked for Bewick Moreing & Co with Hooper and Mercer (qq.v.) in 1895. He was a prime

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mover in establishing the Coolgardie Chamber of Mines and Commerce and was its first president in February 1895. He returned to England in 1896, but retained interests in Australian mining.

WAGC 6 Oct 1894, 23 Feb 1895, 22 Aug 1896, 5 Sep 1896; Reid pp.189, 214

**THORN**, Joseph Franklin OBE, MAusIMM, MIMMAmer. (1879-1957)

Thorn was born in Mariposa County, California, and was educated at San Francisco Technical School and Vander Mailes School of Engineering where he studied mining engineering. For four years from 1903 he was superintendent of Oriental Consolidated Mines which operated gold mines in Korea and for five years he managed gold mines in Nevada. He spent twelve years as a consulting engineer in California and also worked in Mexico as a manager for American Metals Company. Through the good offices of J.A. Agnew (q.v.) who was the chairman of Lake View & Star Ltd and a director of Consolidated Goldfields of South Africa, in 1929 Thorn came to Kalgoorlie to take over the management of Lake View and Star Ltd (ECGF Boulder). The company had recently absorbed Golden Horseshoe Estates Ltd and Ivanhoe Gold Corporation and he reorganised the operations of the three companies to centralise mining operations and to improve coordination. The main shaft was enlarged and deepened and a comprehensive development programme initiated which substantially improved reserves. Dry crushing and roasting of sulphides was replaced by wet milling and the flotation of a concentrate; this operation being the first time flotation had been used for the bulk treatment of gold ore in Australia. Instead of it being necessary to roast all the sulphides as in the former process, only the flotation concentrates had to be roasted in the new process and these provided sufficient sulphur to fuel the roasting process. The company's former timber-fuelled power plant was replaced by diesel engines in a new power plant. Retreatment of the large stock-piles of slime residues on the leases was commenced using powerful sluicing equipment. By the time the gold price rose the mine was able to increase the tonnage of ore treated by a factor of over four.

Thorn was elected a member of the Australasian Institute of Mining and Metallurgy in 1932. He was a director of the WA Cement Company in 1938, and of Wiluna Gold Mines Ltd in 1940. He retired from these positions in 1950, but served as a director of Western Collieries between 1951 and 1955. He was a vice president of the Chamber of Mines of Western Australia between 1931 and 1949 and its president in 1950. He received the gold medal of the Australasian Institute of Mining and Metallurgy in 1944, for his contributions to the mining and metallurgical practice as applied to the ores of Western Australia. He was a pioneer aviator on the goldfields and was an active supporter of the Flying Doctor Service. Thorn, who was widowed in the 1930s, retired from Lake View in 1950 to live in Herne Hill near Perth.

CMWA 1930, 1951, 1958; *WMAil* 17 Aug 1933; *ProcAusIMM* (NS)140, 1945, pp.xliii-xlv; *CEMR* Apr 1945, p.206; *WAus* 1 Jan 1951; Lloyd p.310; *MYBA* 1940, 1951; Gibney/Smith 2, p.301; *ArcAusMM*; Webb, M&A, pp.686-87

**TINLEY**, H.N. ASTC

Tinley was a graduate of Sydney Technical College who practiced as an assayer and became superintendent of the Balmain Chemical Laboratory in New South Wales. He established H.N. Tinley & Company, as mining engineers and assayers, in Coolgardie in 1895, and was a partner of A.G. Holroyd (q.v.) in 1896-97, and of Troughton in 1898.

WAGC 25 May 1895; *WArg* 14 Oct 1902; *KM* 11 Nov 1898

**TREWARTHA-JAMES**, William Henry MIMM. (1859-1939)

Born in Cornwall where his father was a mining engineer, James, to use his original surname, studied at Camborne and Redruth School of Mines. In 1879 he went to the Quebrada Mines in Venezuela as assistant manager. In 1885 he returned to London where, with his elder brother John Henry Cordner James (q.v.) as his partner, he formed James Brothers, mining



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engineering consultants. For professional reasons both brothers adopted hyphenated surnames: Trewartha-James and Cordner-James. In 1895 Cordner-James visited Western Australia where he acquired a number of mines on behalf of the British Coolgardie Prospecting Syndicate, the agency company of James Bros. One of these was registered on 11 May 1895 as Hannan's Star GMs Ltd. (ECGF Boulder). James Bros was appointed its manager. This was one of the first instances in which a London-based engineering consultant was made manager of a Western Australian mine. Previously a company promoter appointed an engineering consultant and an independent locally based mine manager, an arrangement which was proving increasingly unsatisfactory. Trewartha-James visited Hannan's Star in 1898 and 1902. Hannan's Star was the first mine to use commercially the Diehl process for treating the refractory Kalgoorlie sulpho-telluride ore. (The previous successful treatment of Lake View Consols sulpho-telluride ore had been a smaller scale demonstration project). In the Diehl process after crushing the ore the pulp was amalgamated and separated into concentrates and tailings. The tailings were finely ground, agitated with cyanide and bromo-cyanide and filter pressed to remove the gold. Usually the concentrates had to be smelted or treated by roasting and cyaniding but Hannan's Star only produced a small percentage of concentrates which could be ground down to slimes in tube mills and treated with bromo-cyanide, making a more economical process.

Trewartha-James returned to Kalgoorlie in 1907, just before Hannan's Star amalgamated with its neighbour Boulder Deep Levels to form Hannan's Star Consolidated Ltd. A more radical amalgamation occurred in 1910 when Hannan's Star Consolidated joined Lake View Consols to form Lake View and Star Ltd., which was to be a key mine in the future development of the Kalgoorlie-Boulder mines. Bewick Moreing & Co., which had been manager of Lake View Consols became the manager of the new company, Lake View and Star, while James Bros, which had been the manager of Hannan's Star Consolidated, became consulting engineer for Lake View and Star.

WAGC 8 Jan 1897; JCMWA 1907; Reid p.298; Skinner 1897, 1899; RH Kalg cp 5.3

**TRUDE**, Frederick Bird AMAusIME. (c.1861-1931)

Born in southern England, Trude emigrated to New Zealand in 1880 and worked in mines on the west coast of the South Island and at Thames in the North Island, before travelling to Australia, where he worked at Charter's Towers, in New England, and at Broken Hill. After moving to Western Australia, he was on the Murchison Goldfield in 1895, and in 1899-1903 was manager of Croesus South GMs Ltd (ECGF Kalgoorlie), the leases of which adjoined the northern side of Hannan's Brownhill. He managed for a short time Londonderry GM Ltd (CGF Londonderry) in 1902-03 and Hope's Hill GMs Ltd (YIGF Hope's Hill) from June 1902 to February 1904. He managed Webster's GM (MMGF Webster's Find) from March 1904 to December 1904 when it ceased operation and Greenmount GMs Ltd (YIGF Greenmount) from March 1904 to December 1904 when the company was reconstructed. He also represented a number of other companies on the Chamber of Mines which were: Perseverance GMs Ltd (MMGF Webster's Find) Mar 1904-Feb 1905; Esperanza Westralia Ltd (DGF Norseman) Jun 1905-Dec 1909; Ingliston Extended GM Ltd (MGF Meekatharra) Feb 1906-Oct 1906 and as the mine's second representative Jan 1913- Feb 1917; Karangahake Ms Ltd (MGF Meekatharra) Feb 1909-June 1910; Commodore GM Co. NL (MGF Meekatharra) June 1912- Dec 1913. He also acted as engineering consultant to several of these companies.

Trude owned a public crushing battery at Ruby Well near Meekatharra. It crushed 2567 tons of ore in 1914 but after the State Battery was established at Meekatharra in 1914 the quantities crushed at Ruby Well were much smaller. Trude moved to Sydney and subsequently worked in Fiji and in Egypt.

JCMWA 1902-1917; Skinner 1904, 1905, 1907; MBEJ 20 Mar 1909 p.5; Battye 2 p.355; RDM 1914 p.72, 1916 p.46; Sydney Morning Herald 26 May 1931; Gibney/Smith 2, p.309; ArcAusMM

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### **TRUDE**, Herbert Richard

Herbert Trude was manager of Cumberland Niagara GM (NCGF Kookynie) for Jan-July 1903. He followed Frederick Trude (probably his brother) as manager of Croesus South GMs Ltd (ECGF Kalgoorlie) for Sept 1903-Jan 1904. Greenmount GMs Ltd, the company whose mine (YIGF Greenmount) Frederick Trude managed in 1904, was reconstructed in 1905 as Greenmount GMs Co. NL and Herbert Trude took over the management of the mine until its closure in February 1911. Trude was in Perth in 1913. He became a representative for American Cyanamid in the 1920s (see S.G. Turrell) and left Kalgoorlie soon afterwards.

*JCMWA 1903-1911*

### **TURNER**, E.F.

Turner was employed as a mining technologist by Bewick Moreing & Co., mining consultants and mine managers, at mines managed by the company. From February 1906 to December 1909 he worked at South Kalgurli GMs Ltd (ECGF Boulder) and from December 1909 to December 1910 at Oroya Brownhill Co Ltd (ECGF Kalgoorlie-Boulder). He represented both companies on the Chamber of Mines of Western Australia. At the end of 1910, Oroya Brownhill Co. amalgamated with Golden Links Ltd (ECGF Kalgoorlie-Boulder) and Kalgoorlie Amalgamated (New) Ltd (ECGF Kalgoorlie) to form Oroya Links Ltd to which Turner was transferred. He represented Oroya Links on the Chamber of Mines until 1918 when he left the company. Oroya Links had a peak annual gold production of 41 thousand fine oz in 1911, which was the eighth highest in the state in that year.

*JCMWA 1906-1918*

### **TURNER**, W.H.

Turner was manager of the Golden Rhine GM Co. (MMGF) at Laverton in 1900-01. It was only a short term mine and he moved to another Laverton mine, Ida H. GM Co. in 1901. It operated until 1920 and had an average annual production of 9 thousand fine oz of gold and a yield of 15 dwt per ton. Turner represented the mine on the Chamber of Mines from 1902 to 1909. He also represented Central and West Boulder GM (ECGF Kalgoorlie-Boulder) from 1903 to 1905.

*JCMWA 1901-1905*

### **TURRELL**, Samuel George MAusIMM. (c.1881-1940)

Turrell graduated from Ballarat School of Mines with a diploma in mine surveying and worked as a surveyor at Norseman, Yundamindera and Davyhurst. From 1901 he worked with W.G. Manners (q.v.) on the construction of No.1 sulphide mill for Golden Horse-shoe GM Co (ECGF Boulder) which involved the conversion of the former 50 head oxidised mill. No.1 mill was followed in 1902 by the first half of a new 100 stamp mill (No.2 mill). No.2 mill was not completed until 1904 and after Edwards Duplex furnaces had been installed in 1906 to treat the concentrates, the No.2 mill represented the most advanced version of stamp mill treatment in Kalgoorlie. Turrell established an independent office in Kalgoorlie in 1904 and was working in Norseman in 1910, and in Kalgoorlie in 1921. In that year he was elected a member of the Australasian Institute of Mining and Metallurgy. He became the Australian representative of the American Cyanamid Company in 1926, and moved to Melbourne, although he maintained an office in Kalgoorlie. The Cyanamid Co. developed a cheaper form of cyanide in Canada in 1915 but the Cassell Cyanide Co. which was the company which originally held the MacArthur-Forrest gold extraction patents, retained a near-monopoly on sales of cyanide in Australia until 1923. After that the Cyanamid sales expanded rapidly and by 1939 the company held 60 per cent of the cyanide market share in Australia.

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Reid p.266; *MCER* Mar 1936 p.170, Sept 1940 p.434; 'Obit' *ProcAusIMM* 119, Sept 1940, Lviii; A.L. Lougheed, *Cyanide and Gold*, Queensland, 2001, pp.112-20

### V

**VAIL**, Herbert Eugene MIMM, MIMMAmer, MAusIMM (c.1870-1938)

Born at Forbestown in California where his father was a mining engineer, Vail graduated from the University of California, and was employed at the Gold Bank in Forbestown and at the Utica Mine at Angel's Camp. He then worked at the Shakespeare Mine as underground manager and returned to the Utica Mine for three years as assistant metallurgist. After a period at the Curzon Creek Gold Mine he worked for seven years as metallurgist and assistant manager at the Eagle Shamut Mine. He joined Bewick Moreing and Company, the London-based mining engineers and mine managers, in Australia in 1899 or 1900, at a time when Bewick Moreing began to take a more active role in managing the mines which it had established in the colony. Shortly after Vail's arrival he was appointed superintendent of the mines managed by Bewick Moreing in the colony which then numbered about fifteen, most of which were in the early stages of development. His supervisory work was limited, however, as at the end of 1901 Herbert Hoover was made a partner in Bewick Moreing and was given the responsibility for managing mines under the firm's control. In 1901 Vail was Bewick Moreing's manager of the British King mine (EMGF) on an island in Lake Darlot in the East Murchison and, in 1904-05, he managed Bellevue Consolidated Ltd (EMGF) at Sir Samuel. The company had already been reconstructed twice and struggled on for another five years before finally closing. Vail was in charge of the Cosmopolitan Pty mine at Kookynie (NCGF Niagara) for a few months at the end of 1905 and then of Lake View Consols Ltd (ECGF Boulder) during 1906. He visited London in 1907, returning in 1908 to manage for Bewick Moreing the joint working of two adjoining Kalgoorlie mines, Hannan's Star GMs Ltd (EMGF Boulder) and Boulder Deep Levels Ltd (EMGF Boulder). In 1909 the two companies amalgamated to form Hannan's Star Consolidated and, in 1910, the joint company combined with Lake View Consols to form Lake View and Star Ltd of which Vail was manager between 1913 and 1929. James Bros which had been consulting engineer for Hannan's Star became the consultant for Lake View & Star. As Bewick Moreing was no longer manager of Lake View Vail ceased to be employed by the company and became the independent manager of Lake View & Star. During the 1920s Vail began to rationalise many of Lake View's outdated procedures. However improvements were limited by the amount of capital available. From 1929 large investments in Lake View & Star by Consolidated Goldfields of South Africa enabled improvements to commence. After J.A. Agnew (q.v.), chairman of Lake View & Star, invited J.F. Thorn (q.v.), an experienced American mining engineer, to take over the management of the mine, Vail resigned and became the Perth-based consulting engineer to the company.

In 1917 Bewick Moreing ceased to be manager and consultant to Yuanmi GMs Ltd (EMGF Youanmi) and an independent manager, L.B. Williams (q.v.), became the mine's manager and Vail became the mine's consultant and its representative on the Chamber of Mines from 1917 to 1920. He was also consultant to Wiluna Gold Mines Ltd and in 1925 suggested that the flotation process might be suitable for processing the mine's refractory ore. In October 1925 he submitted samples to the Metallurgical Laboratory of the School of Mines for preliminary testing. The Laboratory's research metallurgist, A.S. Winter, found that a good flotation concentrate was obtained from a saline solution using a potassium xanthate reagent. In 1935 Vail was a director of Hadfields WA Limited, a steel casting and processing company, the establishment of which in Perth made an important addition to the region's metal manufacturing capability.

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In 1930 Vail headed the New Occidental Syndicate which held options over a number of old leases at Reedy's Find, 35 miles north-west of Cue (MGF) where it made some promising drill intersections. Vail brought these to the attention of W.S. Robinson who had formed Gold Mines of Australia in 1930 in anticipation of a devaluation of the Australian currency and consequent revival of the gold industry. Robinson formed Western Gold Mines NL to take over Occidental's options and, in 1933, to mine some of the leases he formed a new company Triton GMs NL of which Vail became a director (1935-38). In 1933 Robinson formed Western Mining Corporation Ltd (WMC) with G. Lindesay Clark as technical managing director. To assist its work in Western Australia WMC formed a WA Advisory Committee the two principal members of which were Vail and Richard Hamilton (q.v.) (general manager of Great Boulder Pty). In 1935 Vail also became a director of Central Norseman Gold Corporation (DGF) which was formed by WMC to reopen the Mararoa mine at Norseman.

In 1936 Vail was executive engineer of Yampi Sound Mining Co. Ltd, a company formed by H. Buckley who had purchased the mineral leases on Koolan Island in Yampi Sound with the intention of attracting a larger company to join his company in mining the island's high grade iron ore for export to Japan. In February 1936 Buckley sold the leases to Sir John Connolly who represented the British company, H.A. Brassert & Co which had previously made an iron ore export agreement with Nippon Mining Co. of Japan. Construction of the necessary mining infrastructure on the island commenced in 1936. Vail was responsible for the provision of drilling and mining equipment and explosives. He became managing director of Yampi Sound Mining in 1938. After much public controversy over ore sales to Japan, in March 1938 the Federal Government prohibited the export of all iron ore from Australia. Vail, for Yampi Sound Mining, proposed that the quantity of ore which was to be exported from Yampi be reduced from 20 million tons to 15 million over 25 years but, in June 1938, the Government stated that the export ban would remain. Vail had further fruitless talks on the ban with Prime Minister Menzies in 1940 and, in July 1940, the original agreement between the Federal Government and Yampi Sound Mining was terminated.

Vail was elected a member of the Institute of Mining and Metallurgy of America in 1905, and was a member of the executive council of the WA Chamber of Mines between 1915 and 1930. His published papers include 'Short distance transport at the Lake View and Star Gold Mine' *JCMWA* 12, 1913, pp.993-97.

*JCMWA* 1904, 1905; *MER* Mar 1909; Battye 2, p.339; Skinner 1915, 1920; *CMWA* 1920, 1937; Reid p.62; Colless p.167; *MMg* Nov 1938; *WAMAR* Nov 1938; L.Clark pp.12, 36, 78; Gibney/Smith 2, p.315; *ArcAusMM*; Smith pp.24, 100, 161; L.Hoover diary, 11-12 February 1902, Hoover Presidential Library, Iowa; Bulletin 1, Reports on investigations conducted in the Metallurgical Laboratory of WASM, 1927, p.34

### **VALENTINE, Charles**

(1873-1938)

Born in Scotland at Laurancekirk, near Aberdeen, Valentine came to Australia with his parents in 1888 and completed his schooling in Melbourne. He served an apprenticeship for seven years with the Chaffey Brothers in Mildura, and then worked for James Martin & Company in Gawler in South Australia. After moving to Western Australia in 1890, he was employed by the Jarrahdale Timber Company which exported timber through the port of Rockingham, 30 km south of Fremantle, and then worked on several mines on the Golden Mile including the Great Boulder Pty. in 1907, and also at the Lancefield GMgCo (MMGF Mt Margaret) at Laverton. In 1913 he commenced work at the Sons of Gwalia Ltd (MMGF Mt Malcolm) at Leonora and in 1925 he succeeded H. Beech (q.v.) as chief engineer of the mine. During the 1930s the mine's electricity supply generated by producer gas engines was considerably expanded to become one of the largest gas powered installations in Australia. It was claimed that its gas generators were the largest ever built. The mine's peak annual gold production of 46 thousand fine ounces was reached in 1937 when it was the sixth highest in the state. Valentine died on 27 August 1938. His son, Percy Valentine, was chief engineer at the mine from 1946 until 1950.

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Charles Valentine wrote with N. Dunstan and V.T. Edquist (q.v.) 'Gas power generation at Sons of Gwalia Mine Western Australia' *ProcAusIMM* 88 (NS), 1932, pp.479-505.

*WAMBEJ* 13 April 1907 p.8; Colless p.168; CMWA 1940; Turnbull p.158

**VANZETTI**, Eugenio (c.1844 -c.1908)

Born and educated in Italy where he studied chemistry and metallurgy, Vanzetti worked at mines in France and Spain, and, in ca.1879, migrated to New South Wales where he worked as a chemist and pharmacist in Forbes, Parkes, Mount Hope, Broken Hill and Cobar. In 1894 he moved to Western Australia where he headed a syndicate which acquired the Golden Pig mine (YIGF) and other mines at Southern Cross, and also at Coolgardie and Menzies. Unable to find enough water locally to treat Southern Cross ores, in 1895 he purchased land at Seabrook, near Northam, and a pool in the River Mortlock, and established the Water Trust Mining and Public Crushing Company of Western Australia. The company planned to transport ore by rail from the Golden Pig and other mines to a treatment plant at Seabrook and to carry water back to Southern Cross and to goldfields further east. Vanzetti travelled to London and, with the assistance of Bewick, Moreing and Company, which became the company's engineering consultant, floated the company with a capital of £250,000. The company built a spur railway to Seabrook where it erected a treatment plant complex with a large 80 head stamp battery, part of which began working in May 1897.

Although the Government Railway provided concessional freight rates to the company a number of unforeseen factors affected the viability of the project. As the mines were deepened a larger percentage of the water required by each could be provided from groundwater and the introduction of cyanidation permitted more process water to be recycled, both of which made the cost of treatment at the mines cheaper. Without other mines using the Seabrook scheme the company's mines provided inadequate supplies of ore. In the long term the operation of the proposed Goldfields water supply scheme, outlined to Parliament by the Engineer-in-Chief, C.Y. O'Connor, in June 1895, would probably mean that only mines not served by the Government scheme would consider using the Seabrook scheme. In January 1898 the company was restructured as the Northam Milling and Mining Company and in the following month it transferred operation of the battery to Bewick Moreing and Co. The transportation of ore from the goldfields continued to be too costly and on 26 July 1899 the battery was closed. It resumed working in September 1899 when the Government agreed to carry low grade ore at reduced rates but it only operated for a few months and finally closed in January 1900. In 1902 Bewick Moreing dismantled the battery and plant which was re-erected on the goldfields. Another company formed by Vanzetti in 1896 was the Western Australian Industrial and Mining Tramway Company which planned to construct a tramway to Newcastle (Toodyay) but the demand it was to service was far less than the one to be satisfied by the Seabrook scheme and the Newcastle scheme was even less successful. Vanzetti returned to Europe in 1900 and probably died in Italy in 1908.

WAGC 18 Jul 1896, 22 Oct 1896, 5 Nov 1896, 22 May 1897; *WArg* 21 Jan 1897; GG 1897 p.2403; Skinner 1897, 1900; ADB 12 p.310; Le Page p.273; *Northam Ad* 12 May 1897, 19 Jan 1898; Milhinch, *Seabrook Battery*; *JHSWA* 10 1994 p.587

**VARDEN**, Richard Arthur MAusIMM, MIMM, MAmIME (d.1921)

Born at Worcester in England, Varden graduated from the Clausthal School of Mines in Germany in 1876, and then spent several years working in the mining industry in Mexico and the United States. He moved to Kalgoorlie in 1894, where he managed the opening up of Hannan's Brownhill GMG Co. (ECGF Kalgoorlie), the mine on which prospector J. Cammilleri first located the Oroya lode formation in October 1893. Varden also opened Hannan's Oroya GMG Co (W.A.) (ECGF Boulder). He resigned from the management positions in May 1896 to become the Australian representative of the London mining consultants, Bainbridge Seymour and Company. He returned to London in 1897 and was made a partner in the

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consultancy. During the next decade he worked on mining assignments in Europe, North and South America, Siberia and South and West Africa before returning to Western Australia in 1910 as the local partner in the mining consultancy of Hooper, Speak and Company. In 1911 Varden became manager of the Great Boulder Perseverance GMg Co. (ECGF Boulder) on behalf of Hooper, Speak & Co which had been general manager and engineering consultant to the company since 1909. Varden was appointed a local director of Great Boulder Perseverance in 1915. He was a commissioner of the Royal Commission on Miners Lung Disease in 1911, and a member of the executive council of the WA Chamber of Mines between 1911 and 1917. Between 1911 and 1920 production at Great Boulder Perseverance fell by 30 per cent which was less than the falls experienced by most of the large mines in Kalgoorlie. They represented the consequences of the war and the post-war malaise in the industry which would take over a decade to improve. Varden retired from Great Boulder Perseverance in 1919 and returned to England where he died two years later.

Skinner 1897, 1909; 1915; Battye 2, p.338. *JCMWA* 1911, 1918, 1921; *TAIMM* 31 1921-22; *ArcAusMM*

### **VON BERNEWITZ, Max W.** MIMMAmer, AMAusIMM (1879-1940)

Born in New Zealand and educated at St John's College and the Thames School of Mines, Von Bernewitz worked for five years in the New Zealand mining industry before moving to work in Kalgoorlie, Western Australia. He was assistant metallurgist at Associated Gold Mines (Western Australia) Ltd (ECGF Boulder) under H.J. Daggar, the metallurgist who designed the mine's two hearth furnace for roasting sulphide ore which combined features of both the Edwards and Merton furnaces but which was replaced, in 1912, by Edwards duplex furnaces. Von Bernewitz was appointed metallurgist at Associated Northern Blocks (Western Australia) Ltd (ECGF Boulder) in 1910. He was elected an associate member of the Australasian Institute of Mining Engineers in the same year. After twelve years in Australia, he moved to San Francisco in 1915 to join the editorial staff of the Mining and Scientific Press, and subsequently worked for the US Bureau of Mines for seventeen years. From 1907 until he left for the USA von Bernewitz was the most prolific writer of technical articles dealing with Kalgoorlie metallurgy, writing an average of four or five a year. The articles were principally for the *Mining and Scientific Press* of San Francisco and the *Mining Journal* of London (see below). A typical article reviewed how each of the major mines in Kalgoorlie carried out a particular treatment operation such as dry crushing or filter pressing. The articles were not only well written but were full of operational data and described the problems encountered.

Von Bernewitz's printed papers include the following:

- 'Slime treatment at Kalgoorlie', *M&SP* 14 Dec 1907;
- 'Practical notes on dry crushing mills', *MJ* 4 Sept 1909, pp.299-301 [at Kalgoorlie];
- 'Merton patent ore-roasting furnaces', *MJ* 20 Nov 1909, p.285;
- 'Graphite: An obstacle to good cyaniding', *M&SP* 4 Dec 1909;
- 'Cyanide notes', *M&SP* 7 May 1910 [use of bromocyanide at Kalgoorlie];
- 'Treatment of concentrates at Kalgoorlie', *MJ* 1910, p.646;
- 'Suction gas plants in Western Australia', *MJ* 30 July 1910, pp.45-47;
- 'Filter-pressing slime', *M&SP* 17 Sept 1910;
- 'Concentration of slime', *M&SP* 10 Dec 1910;
- 'Roasting at Kalgoorlie', *M&SP* 13 May 1911;
- 'Slime agitation at Kalgoorlie', *M&SP* 3 June 1911;
- 'Filter pressing', *ProcAusIME* 15 (1), 1911, pp.149-60;
- 'Ball-mill practice at Kalgoorlie', *M&SP* 15 July 1911;
- 'Ball-mill practice at Kalgoorlie', *MMg* Aug 1911, pp.139-46;

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'The Eclipse patent filter', *MER* Aug 1911, pp.433-34;  
'Notes on present metallurgical practice at Kalgoorlie', *MER* 5 Oct 1911, pp.13-19;  
'Ball-mill practice', *MMg* Jan 1912, pp.59-61 [discussion on August article];  
'Ore treatment at the Associated mine, Kalgoorlie', *MMg* Feb 1912, pp.127-29;  
'Custom treatment plant at Kalgoorlie', *MER* March 1912 [Assoc. Northern Blocks' mill];  
'Treatment of matte from mill clean-up', *M&SP* 2 March 1912, pp.239-41;  
'Two new treatment plants in Western Australia', *M&SP* 3 Aug 1912 [Mountain Queen, Yilgarn and Yuanmi];  
'Metallurgy at Bendigo', *M&SP* 17 Aug 1912;  
'Rock-crushers at Kalgoorlie', *M&SP* 12 Oct 1912;  
'Huntingdon-mill practice at Kalgoorlie', *M&SP* 16 Nov 1912;  
'Dry v wet crushing at Kalgoorlie', *M&SP* 15 March 1913;  
'Reminiscences of Western Australia 1899-1912', *CEMR* 5 Oct 1933, pp.50-51;  
'Assaying sulpho-telluride gold ore', *CEMR* 8 Nov 1934, pp.47-48;  
(with R.S. Dean). '*Smelting ores in the electric furnace*', Bureau of Mines, USA, 1937;  
Book edit: *Cyanide practice 1910-13*, Mining & Scientific Press, USA, 1913; (This book reprinted articles on cyaniding which had mainly appeared in the journal *Mining & Scientific Press* during 1910-13.)  
*MCER* Aug 1940, p.406; *MMg* June 1940, p.39.

## W

**WALKEDEN**, George Henry MIMechE (b.1860)

Born in England at Wolverhampton, Walkeden served a mechanical engineering apprenticeship and studied engineering and chemistry at Mason College in Birmingham, and then worked in coal and iron mines and also in iron and steel works. He travelled to Melbourne in 1890, where he worked in Victorian Railways engineering workshops at Newport and in a variety of rural engineering occupations. He joined the Broken Hill Proprietary Company in 1896 and spent a year at Broken Hill where he worked on the design of an ore treatment plant and other works and was then transferred to Port Pirie to supervise construction of the company's smelting and refining works. In 1899 he moved to Western Australia where he was appointed construction engineer of Great Boulder Proprietary GMs Ltd (ECGF Boulder). At the beginning of 1899 the patented Koneman process devised by the American engineer, William A. Koneman (q.v.), to treat the mine's sulpho-telluride ore, after eighteen months of construction and testing, failed at the last hurdle and was rejected. Walkeden was hired to do the detailed design of, and to construct, a sulphide plant to replace the Koneman plant. The new plant was designed by manager Richard Hamilton (q.v.) and was similar to the 'dry crush and roast' process which eventually became the standard Kalgoorlie process and which had been first devised by J.T. Marriner (q.v.) of Great Boulder Main Reef. When the plant had been erected Walkeden accepted a position as engineer to the London and Hamburg Gold Recovery Co. which was constructing bromo-cyanide or Diehl process plants. The Diehl process was the alternative process to the 'dry crush and roast' for treating the sulpho-telluride ore. The London and Hamburg Co obtained contracts for the construction of treatment plants for three mines which were, Hannan's Star (plant handed over in June 1900), Lake View Consols (September 1900) and Hannan's Brownhill (March 1901). All three plants were different as two incorporated items of plant already at the mines. Walkeden, presumably, was responsible for preparing the detailed drawings and for overseeing the construction of the plants. With the three being ordered and built at very similar times, the task could not have been an

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easy one. However, the plants were finished and operating by 1902 when Walkeden returned to London. Soon after he went to gold mines in the Gold Coast and Nigeria on consultancy assignments. On his return he spent nearly two years in London working on experimental metallurgy and designs for gold mines in West Africa and Mexico. In 1907 he returned to Western Australia, where he became the chief engineer and general manager of the London and Hamburg Gold Recovery Company.

Battye 2, pp.346-47; *JCMWA* 1908, 1913

### **WALTON, Harry Grant**

Walton was employed by Bewick Moreing and Co, mining consultants and mine managers, as a superintendent of mines which the company had contracted to manage. In 1908 he managed Hannan's Proprietary Ltd (ECGF Boulder and Kalgoorlie). The company acquired leases which it worked or formed independent companies to work them. In 1909 Walton managed Bellevue Ltd (EMGF Lawlers) at (Mount) Sir Samuel. The company was the third reconstruction of the original company and the mine closed in 1910. Walton then moved to Oroya Black Range Ltd (EMGF Black Range) at Sandstone which was another mine with a short life expectancy and which closed in 1914. From 1912 he also managed Yuanmi GMs Ltd (EMGF Black Range) at Youanmi, which was approximately 100 km south of Sandstone. He continued to live at Sandstone and, although he was provided with a car, daily travelling added to the difficulty of attempting to maintain the viability of two marginal mines. Yuanmi GMs survived the wartime shortages and cost increases, assisted by metallurgical savings made by metallurgists K.B. Moore and H.R. Edmands (both q.v.) and economies made by producer gas power generation. In 1916 the board of Yuanmi GMs, as a further cost saving, dispensed with the services of Bewick Moreing as managers of the mine and Walton was replaced. He became manager of Riverina South Leases GM (NCGF Ularring) at Mulline from 1918 to 1919 when 5020 tons of ore were crushed to yield 5060 fine oz of gold. His published papers include 'Charcoal precipitation of gold bearing cyanide solutions' *RDM* 1916, p.45.

*JCMWA* 1908, 1919; Skinner 1915; Hooper p.85

### **WARD, O.B.**

Ward was the metallurgist at Hannan's Star GMs Ltd (ECGF Boulder) from 1903 to 1906. Hannan's Star, managed by the London engineering consultants, James Brothers, was the first mine to install a Diehl bromo-cyanide plant to process its sulpho-telluride ore. The plant began operating in June 1900 but the mine had difficulty in producing sufficient sulphide ore to keep the Diehl plant running profitably and the company had to be reconstructed in 1905. South Kalgurli GMs Ltd (ECGF Boulder) to which Ward moved as metallurgist in 1907 had adopted for the treatment of its sulpho-telluride ore the rival process to the Diehl one, termed the 'dry crush and roast process'. Both processes depended on very fine crushing of the roasted material and Ward did trials to determine which was the more effective machine, the tube mill (for the Diehl) or the Wheeler grinding pan. In 1908 Ward was appointed manager of Lake View Consols (ECGF Boulder) which was managed by Bewick Moreing & Co. When Lake View Consols was amalgamated with Hannan's Star Consolidated Ltd to form Lake View and Star in 1910, Ward moved to Broken Hill where, in 1913, he was appointed general manager of the Block 10 Mine.

His published papers include: 'Grit mills versus Wheeler pans' *JCMWA* 1904, pp.63-64; 'Some mining appliances in use at the Lake View Consols Mine' *JCMWA* 1909, pp.130-31.

*JCMWA* 1904, 1913, 1918. *MMg* Feb 1912, p.124; Skinner 1915



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**WARRICK**, John MAusIMM. (1866-1938)

Born in Burra, South Australia, and educated in both state and private schools, Warrick worked in a mine in Broken Hill, farmed for a period and worked at Moonta Mine in South Australia for two years before returning to Broken Hill to work at the Proprietary and Central Mines where he was employed as an assayer and surveyor. He travelled to Western Australia in 1895, prospected in the Coolgardie area and managed the Lady Alice GM (CGF Kunanalling) at Kintore for a year. After being appointed underground foreman at the Great Boulder Pty GMs Ltd (ECGF Boulder) in 1896 he became its underground manager in 1897. He was elected a member of the Australasian Institute of Mining Engineers in 1901, and gave evidence to the Royal Commissions on Ventilation and Sanitation in Mines in 1905 and on Miners' Lung Disease in 1911. He succeeded R. Hamilton (q.v.) as manager of the Great Boulder Pty in 1927.

*JCMWA* 1908, 1920; Battye 2, p.348; *CMWA* 1930; Reid pp.61-62; *W Mail*, 17 Aug 1938, p.14; *ArcAusMM* G.Spencer-Compton *JHSA* 5, 1958, iv, p.8; Gibney/Smith 2, p.329

**WATSON**, Latham ABalSM, AMAusIMM (c.1873-c.1942)

A graduate of the Ballarat School of Mines, Watson in 1896 was mill manager and surveyor at Big Blow GMs Ltd (CGF Coolgardie), one mile south of Coolgardie. The managing director of this company, which had been formed in November 1894, was Albert Frederick Calvert, an outback traveller and an enthusiast publicist for Western Australian mining. The mine was a failure despite optimistic puffing by Calvert. When its leases were surrendered, in 1899, it had only produced 861 oz of gold bullion from 3093 tons of ore, a low grade of approximately 6 dwt per ton. In 1898 Watson had moved to Menzies where he was metallurgist and surveyor at Menzies Consolidated GMs Ltd (NCGF Menzies) a year after the mine had started production. The mine operated until 1927 producing 272 thousand ounces of fine gold, the largest total for any of the Menzies mines. In 1902 Watson was metallurgist at the Ida H. GM Co. Ltd. (MMGF Mt Margaret) at Laverton, a year after it started production and, in 1907, he was metallurgist at the Vivien GM Co Ltd (EMGF Lawlers), ten miles north of Lawlers. He was mill supervisor at the Hainault GM Ltd (ECGF) at Boulder in 1909 and, in the same year, was elected an associate member of the Australasian Institute of Mining Engineers. He joined the petroleum industry in 1913 when he was appointed field superintendent of Peruvian Consolidated Oilfields and, in 1923, he became general manager of Trinidad Oil and Transport Company. Subsequently, he was advisor to the Commonwealth Government on oil drilling. In the early 1930s he was prospecting for gold in the Kimberley. He was manager of the Bohemia GM (YIGF) at Marvel Loch in 1935 when possible expansion of production at the mine was being investigated.

*WArg* 28 Oct 1902; *ArcAusMM*; G. Blackburn, *Calvert's Golden West*, 1997, pp.13,19

**WATT**, Edwin Oliver ABalSM, MAusIME

Watt was a graduate of the Ballarat School of Mines and managed mines in Victoria and New South Wales for twelve years before he moved to Western Australia. He was in the metallurgical department of Kalgurli GMs Ltd (ECGF) in Boulder in 1901, the year in which he was elected a member of the Australasian Institute of Mining Engineers. He was at Associated Northern Blocks (Western Australia) Ltd (ECGF Boulder) in 1905, when the mine produced 44 thousand fine oz of gold, which was the eleventh highest total in the state that year. From 1907 until 1910 Watt was at Westralian Waihi GMs NL (NCGF Ularring) at Davyhurst, when, in three years, the mine produced 11 thousand fine oz. In 1911 he was at another Davyhurst mine, Homeward Bound GM Co Ltd (NCGF Ularring) which closed in that year after intermittent operation since 1902. In 1914 Watt was metallurgist at the Lancefield mine (MMGF Mt Margaret) at Laverton. In October 1913, Lancefield GM Co Ltd which had operated since 1904 went into liquidation. In January 1914 the mine was bought by Kalgoorlie and Boulder Firewood Co., the company which provided firewood fuel to the mine. The mine was renamed Beria Consols and

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recommenced operations, which was when Watt began as metallurgist. In March 1915 the mine was bought by a group of Kalgoorlie businessmen, one of whom, George Ridgway, the former chief engineer of Great Boulder Pty, took over as manager and refurbished the plant. The mine recommenced in late 1915 under its old name Lancefield GMg Co Ltd.

Watt's published papers include: 'Some modern methods of ore treatment by cyanidation' *TAusIME* 9-11 1905, pp.76-95; 'Cyanidation at the Kalgurli Mine, Kalgoorlie' *E&MJ* 29 August 1903, pp.315-17.

*JCMWA* 1903, 1905, 1907; *WAMBEJ* 23 April 1904, p.8, 8 March 1905, p.20; *MER* April 1914, p.197; *ArcAusMM*; Gunzburg/Austin p. 200

### **WAUCHOPE, Albert** ASASM, MAusIME. (b.c.1870)

After graduating from the South Australian School of Mines, in 1893 Wauchope was appointed metallurgist at the Virginian and New Milo gold mines at Wadaminga in South Australia. In 1895 he was manager of the Cobar Development Syndicate which was establishing a gold mine at Cobar in Robinson County, NSW, and, in 1896, of the Woodside Consolidation Syndicate. Moving to Western Australia in 1899, he became the metallurgist at the Lady Mary Mine (DGF), which was 8km south of Norseman, and later in the same year of Great Boulder Main Reef Ltd. (ECGF Boulder) which was under the general management of mining engineers, Bainbridge, Seymour and Co. Wauchope was appointed metallurgist and chief chemist at the Fremantle Smelting Works Ltd in 1900. The smelting works at South Fremantle were built by Western Australian Smelting Co Ltd and operated from 1898. In April 1900 the company taken over by Fremantle Smelting Works Ltd, a company formed by Charles Kaufman (q.v.) who appointed John Sutherland (q.v.) manager. However, the smelter ran into technical and financial problems and closed down in 1902. Wauchope returned to Kalgoorlie and was superintendent of Great Boulder Main Reefs from 1907 to 1909. Bewick Moreing and Co had by then taken over the general management of the mine from Bainbridge Seymour & Co.. In 1911 and 1912 he was manager for Bewick Moreing of Gwalia Consolidated Ltd (EMGF, Wiluna) (formerly Star of Gwalia). He was manager of Yuanmi Gold Mines Ltd (EMGF Black Range), at Youanmi in 1913, and of the Sons of Gwalia Ltd (MMGF) at Leonora from 1914 to 1917. He was elected a member of the Australasian Institute of Mining Engineers in 1911 and was living in Cottesloe in 1919. His published papers include: 'Surface equipment of the Sons of Gwalia Gold Mine, describing recent additions thereto' *JCMWA* 14, 1915, pp.122-27 (part 1) & 158-62 (part 2). In 1900 he registered with W.G. Manners (q.v.) Western Australian Patent 4846 for 'Improved asphaltum or tar' and in 1907 a provisional Commonwealth Patent 10112 for 'a pressure filter' which he did not complete.

*JCMWA* 1905, 1908, 1915; *ArcAusMM*; Patent Register of W.G. Manners

### **WEEKLEY, Thomas**

Weekley was manager of Menzies Consolidated GM (NCGF) at Woolgar, six km south of Menzies in 1897, shortly after it commenced operation. The mine was a consistent producer over thirty years, averaging 9,000 fine ounces per year. Weekley was intermittently employed by Bewick Moreing & Co. for ten years at mines which the company managed. He was the company's manager of Merton's Reward GMg Co (MMGF Mertondale) in 1903 and 1904 before the mine returned to independent managers in 1905. Weekley managed Fenian GMg Syndicate (MGF Meekatharra) in 1911 shortly after the Syndicate took over the leases after they had been profitably worked for nine years by the original prospectors and their associates.

*JCMWA* 1903, 1904; Skinner 1899, 1903, 1904, 1905

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**WELLSTED**, Edward James

(1867-1927)

Born and educated in Sussex, England, Wellsted was the brother of Thomas W. Wellsted who became a partner in Bewick Moreing and Co., mining consultants and mine managers, in 1901. Edward joined the stores purchasing department of Bewick Moreing's London office in the 1890s. In 1902 he moved to Fremantle where he established and managed Bewick Moreing's centralised stores and buying department to supply mining companies under Bewick Moreing's management. From 1905 to 1907, he was business manager at Bewick Moreing's state head office in Kalgoorlie. In 1907 he was accountant at the Bellevue Ltd mine (EMGF Lawlers) at (Mount) Sir Samuel after the company's third reconstruction. He was at Oroya Links Ltd (ECGF Boulder/Kalgoorlie) from 1911 to 1918 after the company had been formed from the amalgamation of Oroya Brownhill, Golden Links and Kalgoorlie Amalgamated (New). He represented these companies on the Chamber of Mines and also Lake View and Star (ECGF Boulder) from 1919 to 1920 when Bewick Moreing ceased to be manager of the mine. Wellstead became manager of Bewick Moreing in Western Australia in 1925 and in that year he gave evidence to the Royal Commission on Mining. He died in 1927 aged 60.

WAMBEJ 22 July 1905 p.11, 6 Sept 1913 p.12; JCMWA 1907, 1913, 1920, 1927; 'RRC Mining' V&P WA 1925, 3

**WHILLAS**, Charles John

(b.c.1871)

Whillas was born in South Australia and received his technical education at the South Australian School of Mines from which he graduated with diplomas in mining and mechanical engineering. In 1893 he moved to Western Australia to join Nannine Consolidated GMs Ltd (MGF Nannine) which was a subsidiary of the Mt Yagahong Exploration Co. Ltd. (MGF Nannine). In 1895 he was appointed general manager of Mt Yagahong Exploration Co. Ltd, the parent company of a number of Nannine companies. In 1895-96 he was resident manager of a subsidiary of Nannine Consolidated, Queen of the Lake Leases at Nannine, which, in 1897, produced 4.9 thousand fine oz of gold from 8.6 thousand tons of ore. From September 1903 until June 1904, Whillas was resident manager of Abbotts Pty GMs Ltd at Abbotts which was 30km north of Meekatharra. In addition to being the owner of a number of subsidiary mining companies in the Nannine and Meekatharra district Mt Yagahong Exploration Co. Ltd also operated a mine at Nannine. Whillas represented Mt Yagahong Exploration and Abbotts Pty at the Chamber of Mines of WA in 1903 and 1904. Mt Yagahong Exploration's mine produced 9.5 thousand fine oz of gold from 14 thousand tons of ore between 1897 and 1903. By 1904 returns were diminishing for the mine and its subsidiaries and in March 1904 the company changed its name to Mt Yagahong Exploration and Finance Co. Ltd. Whillas left the company in July 1904.

GG 1897 p.389, 1899 p.1918; Skinner 1897, 1903, 1905; JCMWA 1903, 1904; Thiel pp.284-89, 338

**WHITE**, David Hunter

A finding of the 1898 Royal Commission on Mining that crushing at private batteries was too costly for small leaseholders prompted the Forrest Government to provide Public Batteries in regions where no crushing facilities were available. In March 1898 David White was appointed Superintendent of Public Batteries. He was required to decide where the batteries were needed and to expedite their installation. Remarkably, by the end of 1898 eight batteries were in operation spread over a large area from Yalgoo to Norseman. However, insufficient funds had been spread too thinly and many of the batteries were accepted by the government in lieu of back rent. Parts were not standardised; breakdowns were frequent and maintenance fitters difficult to retain. A State Batteries Inquiry Board in 1906 unduly criticised White and he resigned soon after. In 1913 when the number of batteries peaked there were 37 operating batteries. Peak production occurred in 1938 when 109 thousand tons were milled and 103 thousand tons of tailings treated.

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RDM 1897,1905; BB 1900, 1905; 'Report ... State Batteries Engineering Board' V&P WA 1906, A9; E.J. Green, 'State Batteries', 1987

### **WHITFIELD**, Prof. Hubert Edwin BA, BE, MIEAust, MAusIMM (1875-1939)

Born in Sydney and educated at Sydney High School, Whitfield studied engineering and arts at the University of Sydney, graduating in civil engineering, mining and metallurgy in 1902. In the same year he started work underground in Kalgoorlie at Associated Northern Blocks (WA) Ltd (ECGF Boulder) and in the cyanide plant of Shamrock GM Co Ltd at Kanowna (NECGF). He was foreman of the Golden Crown cyanide plant at Kanowna, and then, in 1903, assayer for the Murchison Associated GM at Day Dawn (MGF). He worked in the bromo-cyanide plant at the Ivanhoe Corporation (ECGF Boulder) in 1904. He was acting manager and metallurgist at the Croesus South GM Ltd (ECGF Kalgoorlie) and manager of the cyanide plant at North Boulder GM Co Ltd.(ECGF Boulder). Whitfield went prospecting in the East Murchison Goldfield in 1906 and located a promising prospect in the Black Range District. A company, Sandstone Development GM Co was floated in Sydney with Whitfield manager and attorney. The mine infrastructure was designed and built and, in three years, 15 thousand fine oz of gold were produced from 26 thousand tons of ore with a yield of 12dwt per ton. However, in 1910, the works ran into unstable underground conditions in which it was impossible to continue mining and the mine was closed. Whitfield moved to Perth and, in 1912, was appointed the first Professor of Engineering and Mining in the newly established University of Western Australia. He was Vice-Chancellor of the university between 1913 and 1915 and again between 1925 and 1935. He worked for the British Ministry of Munitions between 1916 and 1919, first as an inspector of munitions in the United States and then as a technical adviser to the British Government in London. On his return to Australia, in 1919, he investigated, with T. Blatchford (q.v.), ground water problems at the Edna May gold mines at Westonia (YIGF). A government supported scheme of pumping was recommended. He was a founder member of the Western Australian Institution of Engineers in 1910 and also of the Institution of Engineers, Australia, in 1920.

His published papers include: 'British inspection of steel in America' *TWAIE* 10, pp.94-112; 'Proposal for the improvement of the status and remuneration of Engineers' *TIEAust* 1, 1920, p.476 (abst).

*JCMWA* 1913; Fraenkel, P.H.,Chairman's address, Perth Div., IEAust, 1935; *WWA* 1938, pp.526; 'Obit' *TIEAust* 12, 1940, p.333; *ADB* 12 Alexander ArcEA ArcAusMM

### **WHITFIELD**, C.A.

Whitfield was made a partner in Percy J. Ogle & Company, engineering consultants and mine managers, in the late 1900s. In London he began the oversight of mines managed by the company in Australia in 1906 or 1907, the principal ones being North White Feather GMs (NECGF Kanowna) and Hannan's Main Reef GM Co (NCGF Niagara). After a disagreement with Whitfield, the manager of these two mines, William De Mole (q.v.), resigned in July 1907. Whitfield came out to Australia and took over the management of North White Feather for the year 1908-09. (The mine remained open until 1924). Hannan's Main Reef was closed in 1908 and a new company, Orion Ms Ltd, took over its productive leases and other new leases and continued operations. Whitfield was manager of Orion for year 1910-11. The mine was open until 1915 and produced 12,354 fine oz of gold from 24,772 tons of ore. *JCMWA* 1909, 1911

### **WHITWORTH**, Samuel (d.1923)

Whitworth worked at several mines during the 1890s in the Yilgarn and Coolgardie Goldfields including Fraser's South Extended GM Co. Ltd (YIGF Southern Cross). He also erected and operated a 20 head stamp battery at Broad Arrow. He returned to England in 1900 where he was trained to erect and operate the Elmore oil flotation process for Australian Ore

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Concentration Syndicate, the company formed by Frank and Stanley Elmore to market the Elmore process. It was the first successful commercial flotation process and had been devised by the brothers in 1898 at their Welsh copper mine for concentrating copper from low grade ore. A demonstration plant was built in London on which sulpho-telluride ore from several Kalgoorlie mines were tested, as a result of which Lake View Consols (ECGF Boulder) ordered a 50 ton per day pilot plant. In the Elmore process mineral particles were preferentially attached to a heavy mineral oil and were buoyed to the surface of the treatment vat. It was claimed that the advantage of the process was that it produced a rich concentrate containing over 90 per cent of the free gold, pyrites and telluride so that only the concentrate had to be treated to remove the gold and not the sands and slimes. Whitworth returned to Western Australia and installed the plant at Lake View Consols and trials were carried out in 1903, under the Lake View Consols manager, D.E. Bigelow (q.v.). Several aspects of the process appeared to require further development. The main problem was that if the concentrate contained less than 90 per cent of the gold, the tailings would require further treatment. Lake View Consols decided not to proceed with a full scale plant. Whitworth later joined Fraser and Chalmers as the company's state representative and plant erection engineer. He died in Kalgoorlie.

Charleton p.408; RH.Kalg ch 5.3; Quartermaine pers. com. 1993; R.W. Birrell, Monograph 7, p.2.

### **WICKHAM**, James Macpherson AMIMM (1874-1914)

Wickham who was born in England, from 1897 to 1900 was prospecting for the Hampton Plains Estate Ltd on the land owned by the company near Coolgardie (parts in CGF, ECGF & NECGF) and in opening up mines there. In 1902 he undertook a year's course in electrical engineering at General Electric Co. Ltd at Birmingham, England, following which he returned to Australia. In 1906 he was in charge of ore reduction operations at Red Hill Westralia GMs Ltd (CGF) near Lake Lefroy, south of Coolgardie. In the following year he was responsible for the primary crushing batteries at the Sons of Erin GM which was mining the same ground as Red Hill Westralia. In 1909 he held a similar position at Great Boulder No.1 Ltd (ECGF Boulder) and in 1910 he was manager of the Corinthian mine being worked under option by Bullfinch Pty (Western Australia) Ltd (YIGF Bullfinch). For six months subsequently he was manager of the Moss Reduction Works which was custom processing the Bullfinch ore. In 1911 he left Australia to become assistant manager of the Teria tin mine in Northern Nigeria after which, in 1912, he was sampler at a mine in British Columbia. In 1913 he returned to Nigeria as assistant manager at Ropp Tin Ltd but fell ill. He returned to the UK but failed to recover and died aged forty in 1914. He was elected an associate of the Institution of Mining and Metallurgy in 1913.

*TIMM* 23 (1913-14) p.529

### **WILLIAMS**, Ernest AMICE (c.1861-1936)

Williams became a pupil of civil and mining engineer, Thomas J. Bewick, in 1877, indentured to the Institution of Civil Engineers. He worked on the development of the Langley Barony Lead Mines in Northumberland and on the construction of lead smelting works at Hebburn, near Newcastle upon-Tyne, and other mining works in the north-east of England. In 1887, Bewick formed a partnership with a former pupil, C. Algernon Moreing, as consulting mining engineers and mine managers, under the title Bewick Moreing and Company. Williams moved to Johannesburg on behalf of Bewick Moreing in 1889 and subsequently became general manager for the company in South Africa and the Transvaal. Edward Hooper (q.v.), another former pupil of T.J. Bewick, came out to Western Australia as Bewick Moreing resident partner in 1894. He established offices in Cue and Coolgardie and travelled extensively. In 1895 the company's state manager had to return to London and Williams was transferred from Johannesburg to replace him. He arrived in Coolgardie in 1897 and was an early member of the Coolgardie Chamber of Mines and Commerce. (Kalgoorlie Chamber of Mines was formed in August

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1896 and the two Chambers were amalgamated in March 1901 to form the Chamber of Mines of Western Australia). The staff numbers employed in the Bewick Moreing Kalgoorlie office increased rapidly from 1895 with 15 professionals working out of the office in 1898 and seven others managing mines. In 1898 Hooper returned to London to negotiate a new partnership with Moreing (which was shortlived) and Williams became the senior representative of Bewick Moreing in Western Australia. In 1897-98 there was a series of disagreements between Williams and Herbert Hoover, working for the first time as a mine manager at the Sons of Gwalia Ltd (MMGF Mt. Malcolm) at Leonora. Williams was trying to assert his authority over a junior employee while Hoover considered that he was being victimised. Moreing sent Hoover to China and, in 1899, Williams resigned and returned to South Africa. Hoover was made the Bewick Moreing partner responsible for managing mines supervised by Bewick Moreing in 1901. In 1904 Hoover made an ill-judged agreement to manage Great Boulder Perseverance GMG Co Ltd (ECGF Boulder) but after a Royal Commission and much unfavourable publicity the agreement was cancelled. Hooper's consultancy partnership (Hooper and Speak) was appointed general manager and engineering consultant to the mine. In 1908 Williams was made a partner (forming Hooper Speak and Williams) and returned to Kalgoorlie to relieve the Great Boulder Perseverance manager, E. Hogan Taylor (q.v.), who had left Hooper and Speak to join Bewick Moreing as manager of the Lancefield mine at Laverton. After a year at Great Boulder Perseverance Williams returned to England in 1911. He worked on the Hollinger Goldfield in Canada after 1912. He returned to Western Australia in 1923 to become general manager of Boulder Perseverance Ltd which had been reconstructed from Great Boulder Perseverance GMG in 1923. Williams gave evidence to the Royal Commission on Mining in 1925. He retired in 1931 and was in London in 1932-33. However he returned to Kalgoorlie in 1933 to investigate, with G. Lindesay Clark, on behalf of the Melbourne-based Collins House Group, the consolidation of several mines on the eastern side of the Golden Mile, including the Brown Hill, Iron Duke, Australia East and Oroya South Block. This work was for the Champagne Syndicate, formed by W.S. Robinson of Melbourne and was to be the beginning of Gold Mines of Kalgoorlie. Williams was back in Kalgoorlie again in 1935 for another term as general manager of Boulder Perseverance Ltd.

WArg 19 Jan 1899; GG 1899, p.1623; Skinner 1900; *WAMBEJ* 6 Feb 1909 p.5; *JCMWA* 1910; *CMWA* 1923, 1930, 1934; *TIMM* 46 1936, p.835; L.Clark pp.64-65; Gibney/Smith 2, p.345; *MJ* 21 Feb 1899.

**WILLIAMS**, Leslie Ballesat BME, MAusIME, MIMM. (c.1870-1942)

Williams graduated from Sydney University in 1902 with a degree in mining and metallurgy and moved to Western Australia where, in 1904, he joined Bewick Moreing and Co, mining consultants and mine managers, to become chemist and assayer at Great Fingall Consolidated Ltd (MGF Day Dawn) of which Bewick Moreing was general manager. Williams became a field or inspecting engineer for Bewick Moreing in 1906 and for the next ten years he carried out ninety per cent of the company's inspections of mine sites in the northern goldfields of Murchison, Yalgoo, East Murchison and Mt Margaret, that had been proposed by prospectors or small mine owners for development by private companies promoted by Bewick Moreing. Between 1906 and 1915 Williams prepared over sixty reports on such sites; some of the reports covering up to as many as five different sites in one locality. In 1910 he was based at Lake View Consols Ltd. (ECGF) at Boulder in preparation for its amalgamation with Hannan's Star Consolidated Ltd to form Lake View and Star Ltd. In 1912 another amalgamation was arranged by H.C. Hoover (q.v.). The investment arm of Lake View Consols was combined with Oroya Exploration Co which was the investment and exploration arm of Oroya Links, the Kalgoorlie mining company, to form Lake View and Oroya Exploration and Finance Co. In addition to the investments of Lake View and Oroya Links the new company also took over the new mines being developed in Western Australia by Oroya Links. The main one of these, at Meekatharra (MGF), was managed by Williams from 1913 to 1916, when it produced 45 thousand fine oz of gold at a yield

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of 8 dwt per ton. When Yuanmi Gold Mines Ltd (EMGF Black Range) dispensed with Bewick Moreing as its general manager in 1917, Williams became the mine's independent manager until it closed down in 1920. He was elected a member of the Australasian Institute of Mining and Metallurgy in 1910 and was chairman of the Murchison Committee of the WA Chamber of Mines in 1915-16. He moved to Great Britain in 1922, where he became manager of the Mill Close Mine in Derbyshire.

*JCMWA* 1910, 1920; Skinner 1920; *MMg* Mar 1942, p.116; Hooper p.85; *ArcAusMM*; Nash pp.398-400; DMP Bewick Moreing Collection

### **WILLIAMS**, Thomas

In 1896 Williams was manager of Murchison New Chum GMs Ltd at Mt Magnet (MGF) and in 1899 of Chums Consolidated Ltd (MGF) which probably included the New Chums' leases. Chums Consolidated operated from 1897 to 1902 and produced 26,353 fine oz of gold from 11,984 tons of ore with a useful yield of 44 dwt per ton. In 1904 and 1905 he managed Cumberland Niagara GMs Ltd at Kookynie (NCGF) which operated from 1904 to 1906 producing 5,179 fine oz from 11,082 tons of ore at a yield of 9.3 dwt per ton.

Skinner 1897, 1903; *JCMWA* 1904, 1905; Reid p.285

### **WILLIAMS**, Thomas H. MAusIME. (b.c.1870)

After working in the Bendigo Ironworks in Victoria, Williams was works manager of the Pioneer Engineering Company in Kalgoorlie, and was chief engineer of the Sons of Gwalia Ltd (MMGF Mt Malcolm) in 1906. He was elected MAusIME in 1910 when at the South Blocks Mine at Broken Hill. He was at Marvel Loch North Mine (YIGF Marvel Loch) in 1914, and at Leonora Gold Blocks (MMGF) at Leonora between 1915 and 1922.

*MER* Nov 1916, p.28; *WAMBEJ* 2 Oct 1916, p.7; 'RSC ...boiler explosion ... Sons of Gwalia Mine' V&P WA 1906 A9; *JCMWA* 1914, 1917; *ArcAusMM*

### **WILSON**, Archibald Torrence JP. (c.1859 -1911)

Wilson was born in Ayrshire, Scotland, and worked in coal mines in Ayrshire and in New South Wales and in gold mines at Charters Towers, Queensland. He moved to Southern Cross in 1894, where after working in several mines, he became underground manager at Frasers GM (YIGF) and its manager in 1895. He was manager of Hope's Hill GM Co (YIGF Hope's Hill) in 1898-9, then of Greenmount Mines NL (YIGF Greenmount). He also acquired part ownership of the Transvaal Mine (YIGF Greenmount). He applied for WA patent 4767 'An improved method of treating gold bearing cyanide precipitates' in 1904. He was a Justice of the Peace and an active member of the Yilgarn Roads Board.

Skinner 1899, 1900; GG 1904, p.351; P.T. McMahon, 1972, p.193

### **WILSON**, George Benton

Wilson was a law student at Stanford University, California, where he was a friend of Herbert Hoover (q.v.). He graduated with a pre-law AB degree in May 1896, one year after Hoover. In January 1898 he was employed by Bewick Moreing & Co., mining consultants and mine managers, as Hoover's assistant based at the company's Coolgardie offices which then employed 15 mining professionals. He accompanied Hoover on inspections of potential mines and when Hoover became manager of the Sons of Gwalia mine near Leonora, at the end of April 1898, Wilson continued his work as an inspecting engineer. At the end of 1898 Hoover was appointed Bewick Moreing's technical consultant to Chang Yen-mao, Director-General of Mines in the Chinese provinces of Chihli and Jehol (north-eastern China) and in addition Hoover was required to maintain a watch-in-brief over European investments into the Kaiping coal fields, the largest in China. Hoover arrived in

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Tientsin, the provinces' capital, in March 1899 and Wilson and others of Hoover's staff arrived shortly after. In April Hoover and Wilson embarked on a two month long inspection of gold mines in the two provinces including a large mining settlement at Chin Chang Kou Liang which had a potentially profitable quartz mine and a very profitable alluvial mining area. Wilson was placed as 'director' of the alluvial mine to improve its profitability but found the task to be a difficult struggle against mismanagement and thievery. At the end of 1899 Hoover was made Mining Engineer-in-Chief of the Mining Bureau of Chihli and his staff became its employees. In 1900 the Boxer rebellion in northern China became more threatening for Europeans and Wilson who was on a long distance mineral exploration in the Gobi desert was recalled to Tientsin. There he joined the small European population which was besieged in the European quarter for 28 days before being rescued by Allied troops taking the old town from the Boxer rebels and Chinese troops. Chinese and Europeans in the mining industry were concerned that in the post-war chaos the infrastructure of the Kaiping coalfield would be destroyed by troops and bandits and the mines flooded. Chan's German adviser, Gustav Detring, and Hoover persuaded Chan that British troops could protect the coalfield if a British company took over the company operating the mines, the Chinese Engineering and Mining Company, and that additional capital required could be obtained in London. In controversial financial dealings arranged by C. Algernon Moreing, the senior partner of Bewick Moreing & Co., and the Oriental Syndicate, which included London financiers, Edmund Davis and W.F. Turner, ownership of the Chinese Company was transferred to an Anglo-Chinese one of the same name. On the day after the papers were signed for the transfer Hoover was appointed co-manager with instructions to take possession of the properties, the other co-manager being a Belgian diplomat De Wouters who represented the large Belgian content of the new finance. On the first week of March 1900 Hoover installed Wilson as engineer-in-chief of the company and acting general manager when Hoover was absent. Hoover's seven-month period of co-management ended in September 1901 when an American permanent manager took over. Wilson appears to have remained as engineer-in-chief until 1904 when he returned to the USA. His duties in Kaiping were demanding for him as European business methods were being made to supplant the Chinese ones and amongst the European staff there was open rivalry between the Anglo-Americans and the Belgians. In 1905, in the USA, Wilson was appointed consulting engineer to the American Smelting & Refining Company based on Salt Lake City and was responsible for its silver-lead and copper exploration work. In 1931 he had retired to Los Angeles.

Nash 1, pp.100-05, 112-13, 117-19, 160-62; Herbert Hoover Pres. Lib., Pre-Commerce, Mining, Box 49, C.B. Wilson 1906: Photos 41-11, 16, 44; Pers. comm. Prof Limbaugh, Feb. 1999. Typescript 'Hoover associates 1897-08' (31.1.99); DMP Bewick Moreing report collection.

**WILSON**, Richard Cunliffe BSc, BE, MIMM

(b.1879)

Born in Sydney and educated at the Church of England Grammar School and Sydney University, Wilson's early employment details are unknown but in circa 1913 he joined Bewick Moreing and Co. in Western Australia. He was at Yuanmi GMs Ltd (EMGF Black Range) at Youanmi in 1915-16 and represented it on the Chamber of Mines. He joined the WA Department of Mines as an inspector of mines in 1916 but resigned in 1920, during the Hampton Plains goldrush, to manage Hampton Plains Estate Ltd (CGF, ECGF, NECGF) which covered 155,000 acres of freehold land south and east of Kalgoorlie. He rejoined the Department of Mines in 1921 as a field geologist and then as assistant to the State Mining Engineer, A. Montgomery (q.v.). He was appointed Assistant State Mining Engineer in 1926. In the years 1931 to 1934 he took leave without pay to work for Broken Hill Pty. On his return in 1934 he succeeded A.M. Howe (q.v.) as State Mining Engineer, Chief Inspector of Mines and Chief Inspector of Machinery. He retired in 1945 and was succeeded by J.S. Foxall (q.v.). He was consulting engineer to the WA Coal Committee in 1949.



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His printed papers include: 1943 presidential address to the Royal Society of WA, published as 'The Collie Coalfield, its problems and economic improvement' in RDM, V&P WA 1945; *Northampton Mineral Field*, Govt Printer, Perth, 1926.

PSL 1920, 1922, 1935; WWA 1938 p.534; 1950 p.763-64

### **WINTER**, Arthur Sydney MAusIMM

Winter was an Assistant in Chemistry for several years under B.H. Moore (q.v.) at the WA School of Mines in Kalgoorlie, and Research Metallurgist in the Mineral Laboratory from 1924 until the end of 1926. He moved to Zeehan School of Mines and then to Queenstown in 1927, and was at the Bairnsdale School of Mines in 1934. He was elected a member of the Australasian Institute of Mining and Metallurgy in 1918.

His published papers include:

(with B.H. Moore) 'Application of the flotation process to gold ores', *CEMR* v.17, June 1925, pp.353-57;

'Laboratory flotation of Kalgoorlie ores', *CEMR* v.18, Sept 1926, pp.483-85;

'Treatment of low grade ores', ANZAS, Perth, 1926;

'Flotation of auriferous ores. Report on the investigation made at the pilot plant of Oroya Links Ltd on Croesus Pty gold-bearing ore, Kalgoorlie, W.A.', *CEMR* v.19, Oct 1926, pp.10-15;

Thirty reports with B.H. Moore on the treatment of ores at Kalgoorlie were included in RDM 1926, pp.147-224.

RDM 1924, p.125, 1926 pp.147-224

### **WITTENOOM**, Frederick Francis Burdett (1855-1939)

Born near York and educated at Bishop Hale's School, Perth, Wittenoom worked in the Western Australian Bank and from 1874 as a jackaroo at Bowes Station, Northampton. He and his brother explored the Murchison where they took up over 2 million acres in crown leases and established five pastoral stations. Most of their Murchison properties were dispersed after 1891 to meet debts due to drought and a failed venture in the Kimberley, although Frank as he was usually called, retained Boolardy and Nookawarra stations. He visited England in 1886-87 to raise capital for the Midland Railway and returned with several commercial commissions. In 1893 he established at Day Dawn, near Cue, a wholesale business to provision the Murchison Goldfield, which was very profitable for two years. In 1895 he was engaged by Zebina Lane (q.v.) to act as general manager of Great Boulder Perseverance GMG Ltd which had just been opened and to also look after Lane's other interests in the Eastern Goldfields such as sawmilling and quarrying. Until the mining company built him a house he lived in Coolgardie with Richard Hamilton (q.v.), manager of Great Boulder Pty, who was his consulting engineer and general adviser. They became firm friends and made joint speculative investments in mines with which they were not associated. They sampled and reported for Lane on any promising mines offered for sale. Wittenoom was chairman of the Boulder Progress Committee and located for the Government the position of Boulder townsite so that it was clear of all leases. He and Hamilton invested in several shops in the town. He opened a sharebroker's office in Kalgoorlie and he arranged the first telephone connection between Boulder and Kalgoorlie in 1896 with the assistance of his brother (the Minister for Mines). Frank was a partner in Wittenoom & Turner which was attorney for Central and West Boulder Mine (ECGF) between 1904 and 1913, and for Ida H GMG Co (MMGF Laverton) between 1903 and 1911. He was also colonial director of several British-owned mining companies. In 1897 Wittenoom was offered the management in Western Australia of Dalgety and Co., the stock and station company, which he accepted and left the Eastern Goldfields. In the following year he visited for Dalgety fifty-four pastoral stations in the north-west.

Skinner 1909; CMWA 1911, 1912; ADB 12, pp.553-54; R.F.B. Lefroy (ed.), *Memoirs of Frank Wittenoom*, Carlisle, 2003, pp.53-57, 84

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**WOODWARD, Henry (Harry) Page** FGS, AMICE (1858-1917)

Born at Norwich in England, Woodward was educated at University College School and the Royal School of Mines in London, and worked briefly for the Geological Survey of England and Wales. In 1883 he was appointed assistant government geologist in South Australia and served as geologist on the South Australian and Queensland Boundary Commission. He also examined the principal mines in Victoria. Returning to London in 1886, he spent one year in the metallurgy laboratory of the Royal College of Science, and returned to Australia to become Western Australian government geologist in January 1888. After visiting the colony's principal goldfields, he summarised his observations in the department's annual report of 1890, which were subsequently reprinted, in 1894, as *Mining Handbook to the Colony of Western Australia*. He selected the site for the colony's first artesian bore at Guildford and served briefly as Warden of the Dundas Goldfield in 1893. He resigned as government geologist in December 1895 to join Bewick Moreing and Company, mining consultant, as its local manager in the Eastern Goldfields. He worked for the company for two years before leaving to establish his own practice. He acted as consulting engineer to the Western Australian Collieries and Fireclay Company while it developed a coal mine at Collie. He rejoined the Mines Department in 1905 as assistant geologist under government geologist, Gibb Maitland. He died after a short illness in 1917.

His published reports include 'Absence of artesian water on the goldfields' V&P 1889, A4; 'Report of Government Geologist on Yilgarn Goldfield' V&P WA 1890-91, A4; 'Report on goldfield of the Kimberley District' V&P WA 1891-92, 18; 'Report on the Murchison Goldfield' V&P WA 1892-93, 13; and 'The phosphate deposits of Western Australia' *WAMBEJ* 9 March 1917, p.7.

GG 1893, p.937; Skinner 1900; Battye 1, p.459; Kimberly p.115; *MER* Mar 1917, p.134; *DWAE* 4, p.1762; *BDWA* 4, p.3385; Spillman pp.76-83; Glover/Bevan pp.83-85

**WRAY, C.H.**

Wray was a Mexican Californian who prospected in south-western USA before coming to Western Australia in 1896. He joined Bewick Moreing and Company, mining consultants, and became the company's chief inspector of mining prospects and reporter on their potential for development as company-owned mines. In eleven years he made over 170 reports on potential mines throughout most of the goldfields in the state, with some reports dealing with several mines in one district. He left Western Australia for London in 1907 where he extended the scope of his work onto an international scene, working initially for Herbert Hoover and associated mining consultants. In 1912 he gained widespread recognition for exposing fraudulent reports made on a tin mining prospect in the Jemaa district of Nigeria by the Anglo-Continental Mines Company whose chairman, W.F. Turner, and director, Edmund Davis, already had questionable reputations. The company reported having a lode 75 ft wide, assaying 25% tin and a length of three miles. Wray, reporting for a private syndicate, examined the 'alleged lode' and found only a belt of greisen in which occurred 'occasionally very small patches of tin ore' and that in his opinion the prospect was 'quite hopeless'. Wray's telegram was published in the *Financial Times*. His findings were confirmed by more eminent consultants but not before the value of the mine's shares had varied by £2.5 million in seven months.

*MMg* Nov 1912, pp.329-31; Lou Hoover's diary, 11 Feb 1902, Hoover Presidential Library; DMP Bewick Moreing report collection.

**WYMOND, A.P.** JP

Wymond, who was usually known as Captain Wymond, in 1897 managed Nepean (Western Australia) GMs Ltd (CGF) between Gnarlbine and Londonderry. He was manager and consulting engineer for Hannan's Central Ltd in 1901-03 and

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for Hannan's Consols Ltd in 1901-05 (both ECGF). Hannan's Central had three leases well positioned in the north-central part of the 'Golden Mile' but in two years only recovered small quantities of gold. Hannan's Consols recovered 3.8 thousand fine oz in seven years. Wymond was chairman of the Coolgardie Roads Board in 1898 and was a member of the provisional committee of the Western Australian School of Mines.

WAGC 14 May 1898; Skinner 1897, 1900; RDM 1902, p.65; JCMWA 1902, 1905

## Y

### YOUNG, G.F.

Young was born in Sydney and was educated at Sydney Grammar School. He travelled to Western Australia in c.1895 and prospected with an experienced companion in the Coolgardie district and east of Lake Raeside. From 1898 he worked for a British engineer erecting mining machinery for Fowler Bros of Leeds at Princess Alix GMs Ltd (MMGF Murrin Murrin) and at Malcolm Mines Ltd (also Murrin Murrin) and also worked as an engine driver at the latter. In 1900 he went to Kalgoorlie with an introduction to E. Huntley (q.v.) who was designing and erecting equipment on the Golden Mile. He worked for a short time in the dry crushing plant at South Kalgurli Consolidated (ECGF Boulder) and then joined the staff of Ivanhoe Gold Corporation (ECGF Boulder) in 1902, under manager, Bob Nicholson (q.v.). He worked in the gold room and metallurgical works with T. Blatchford and H.E. Whitfeld (qq.v.) until June 1904. In 1905 he was acting manager of Merton's Reward GMg Co. (MMGF Mertondale) but resigned after 3 months when the company's general manager, C. Kaufman (q.v.), altered Young's monthly report to shareholders to convey incorrect information. In 1906 Young joined with Blatchford and Whitfeld to process slimes accumulated at Lady Robinson GM (NECGF Kanowna) and in 1907 he was the metallurgist at Gwalia Consolidated Ltd (EMGF Wiluna) in an unsuccessful attempt to treat the refractory arsenopyrite ore. At the end of 1907 he was appointed an inspector of State Batteries and was a relief manager for two months at the state battery at Linden, 100 km east of Menzies. It was a new, busy, battery serving a wide area and had an above average yield of 1.1 bullion oz per tonne. Young resigned as battery inspector in mid 1908 when he agreed to join Whitfeld in the development of a new mine at Sandstone which Whitfeld had opened to 200ft. Whitfeld went to Sydney to float a company, Sandstone Development GMg Co., while Young drew up plans for the mine in Perth and Kalgoorlie and purchased the machinery and construction materials. It was all assembled in Fremantle, transported by ship and rail and then hauled by wagon eighty miles to the mine. In mid 1909 the plant was commissioned. Then after six months of profitable work, at 500ft level the mine ran into an underground river of liquid mud and, after months of fruitless efforts to stope the reef as it slid away, the mine was abandoned in 1910. Young accepted a job at the Waihi mine in New Zealand but, passing through Melbourne, he was asked to report on the potential use of timber in the Otway Ranges for mining work. Coming ashore at Apollo Bay he and his wife were captivated by the region and saw no reason to go any further. They bought land for farming and were dairy farmers for the rest of their lives.

G.F. Young, *Under the Coolibah Tree* Melbourne, 1946; E.J. Green, 'State Stamp Batteries in WA & Production', DMP, 1987

## APPENDIX A

## OTHER MINE MANAGERS AND MINING TECHNOLOGISTS with known mining employment in Western Australia 1890-1920

**A**

Adams, H. Grt Bldr Main Reef 1909 (Boulder)  
 Agnew, A. Black Rng Mg 1909 (Sandstone)  
 Aldridge, J.M. Barrambie Rng GM '07 (Black Rng)  
 Alexander, H.. Black Rng W.GM '13-15 (Sandstone)  
 Alford, T. Chaffer's GMg 1911 (Boulder)  
 Allan, C. Morning Star GMs '13 (Mt Magnet)  
 Allen, V.S. N. Boulder GM 1904-08 (Boulder)  
 Angove J. Just in Time GM 1897 (Coolgardie)  
 Armstrong, G. Menzies Alpha Lses 1896-8 (NCGF)  
 Arnell, G. Golden Australia 1899-1900  
 Golden Bardoc Ms 1900 (BAGF)

**B**

Badge, J. Fraser's S. Extd GM '03 (S.Cross)  
 Bails, E. Grt Fingall Con '17-18 (Day Dawn)  
 Baird, W. Viking No1 GM Syn '16-20 (Norseman)  
 Baker, C.A. Grt Tower Hill GMs 1903 (Leonora)  
 Baker, W.H. WASM staff 1905  
 Banon, H.C. West Fingall 1902 (Day Dawn)  
 Bellevue Pty 1902 (Sir Samuel)  
 Barrett, H.E. Lancefield GMg 1903 (Laverton)  
 Beckwith, L.H. Fields Reward GM 1904 (Mt Magnet)  
 Benson, A. Golconda GM 1896-99 (Lake Austin)  
 Berryman, A.W. Craiggimore Pty 1904 (Laverton)  
 Best, G.H.T. Sons of Gwalia 1914 (Leonora)  
 Bevan, N. Westralia & E.Extn Ms 1903-6 (CGF)  
 Bird, R.C. Great Fingall Con '13-14 (Day Dawn)  
 Black, H. Chaffer's GMg 1910-12 (Boulder)  
 Blaker, C.A. Grt Tower Hill GMs 1911 (Leonora)  
 Blakeslee, F.S. Grt Bldr Pers 1902 (Boulder)  
 Blayney, G. Ida H. GM 1913 (Laverton)  
 Bloomfield, A.L. Cosmopolitan Pty 1904 (Kookynie)  
 Bone, K.V.S. Sand Queen GMs 1914 (Comet Vale)  
 Booth, J.R. Bayley's Con GM 1904 (Coolg)  
 Bower, T.B. Lndn & Coolg Explr '03 (Kanowna)  
 Brand, A. Sugar Loaf M 1898 (Kintore)  
 Brandt, W. Hampton Plns Est 1907-08 (Coolg)  
 Bray, J. Golden Pole Ms 1902 (Davyhurst)  
 Bremner, J.G. Lancefield GMg 1917-20 (Laverton)  
 Brodie, J.A. Lake View Consols 1903-4 (Boulder)  
 Brook, R.H.T. Bullfinch S. GM 1911 (YIGF)  
 Brown, C.A. Homeward GM 1910 (Davyhurst)  
 Brown, G.D. Flagship GM 1901-03 (Bulong)  
 Brown, M.M. Sons of Westralia GM '04 (Burtville)  
 Brown, T.V. Lake View Consols 1901 (Boulder)  
 Bryant, J. Morning Star Qtz GM '04 (Mt Magnet)

Bulkeley, R.D. Lancefield GMg 1913 (Laverton)  
 Bull, P.A. Assoc GMs of WA 1908-25 (Boulder)  
 Burkitt, H.C. Prcss Royal GM '08-11 (Norseman)  
 Burridge, H.E. Bendigo & Coolg Pty '99 (Bonnievale)  
 Burrows, N.L. Edna May GM 1917-20 (Westonia)  
 Butefisch, T.A. Prcss Royal GM '08-11 (Norseman)  
 Butler, J.F. Ingliston Cnsols Ext '20 (Meekatharra)  
 Butterworth, G.B. Whim Well Cpr Ms 1915-17 (WPGF)

**C**

Caddy, J.P. Lake View & Star 1914-18 (Boulder)  
 Cale, J. Leonora Gold Blocks 1918-19 (Leonora)  
 Cameron, C. Ingliston Extd GM 1907 (Meekatharra)  
 Campion, J. Hampton Plains Est. 1904-05 (Coolg)  
 Cape, F.W. Chaffer's GMg 1903-08 (Boulder)  
 Carr, S.H. Orion Ms 1913 (Niagara)  
 Carwardine, A.A. Chaffer's GMg 1910-12 (Boulder)  
 Cecil, W.J. Lady Robinson GM 1904 (Kanowna)  
 Chaffey, J.R. Westralia Tinflds 1901 (GMF)  
 Chambers, C.G. Marmont GMg Syn 1910-14 (Day Dawn)  
 Chapman, M.S. S. Kalgurli Con 1915-19 (Boulder)  
 Chappell, R.J. Golden Ridge GMg '04-06 (Boorara)  
 Cheffirs, J. Lake View Consols 1909-10 (Boulder)  
 Chesson, J. Cue One M 1902-03 (Cue)  
 Clark, A. Associated GMs (WA) 1904 (Boulder)  
 Clarke, R. King Solomon's GMs 1902 (Coolg)  
 Clayton, C.H.J. Black Rng W. GM 1913 (Sandstone)  
 Cocks, A. Lady Mary GM 1907-08 (Norseman)  
 Colbran, H. Lancefield GMg 1903-05 (Laverton)  
 Collins, H.W. Sons of Gwalia 1910-13 (Leonora)  
 Great Fingall Con 1914 (Day Dawn)  
 Colquhoun, R.D. Great Fingall Consd '06-10 (Day Dawn)  
 Connor, J.D. Great Bldr Perseverance 1912 (Boulder)  
 Connor, J.L. Gn Horse-shoe Est. 1908-14 (Boulder)  
 Couper, T.A. Black Rng Mg 1906-15 (Sandstone)  
 Black Rng Pinnacles '16-18 (Sandstone)  
 Cosmopolitan Pty 1905-09 (Kookynie)  
 Northern Ms 1910-12 (Lawlers)  
 Mararoa Syn 1906-08 (Norseman)  
 Prcss Royal N. GM '04-08 (Norseman)  
 Burbanks Birthday Gift '07-11 (Burbanks)  
 Lake View & Star 1920-35 (Boulder)  
 Paringa Ms 1904-07 (Kal-Boulder)  
 Peak Hill GF 1909-10 (PHGF)  
 Lake View & Star 1930 (Boulder)  
 S. Kalgurli Con 1934-35 (Boulder)  
 Prcss Royal GM 1911-14 (Norseman)

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## OTHER MINE MANAGERS AND MINING TECHNOLOGISTS with known mining employment in Western Australia 1890-1920

Cropper, C.W.	Golden Pole GMs 1904-10 (Davyhurst)	Ellis, T.	Menzies Con 1918-20 (NCGF)
Cross, G.W.A.	Nw Hannan's Excrs & Croesus 1901-02	Elliston, W.M.	Kalgoorlie Amalg (New) 1909 (Kalg)
Currie, J.M.	Great Fingall Con 1910-12 (Day Dawn)	Elsbury, J.	Greenfinch Pty GM 1919 (Westonia)
Curtis, J.	Great Fingall Con 1910 (Day Dawn)	Eva, H.M.	Oroya Black Rnge '11-12 (Sandstone)
Curtis, W.S.	Chaffer's GMg 1913 (Boulder)	Evans, R..	Yuanmi GMs 1912 (Youanmi)
Curwood, H.B.	Chaffer's GMg 1911-12 (Boulder)	Evans, S.	Malcolm Ms 1902-05 (Murrin)
		Eyre, T.	Kalgurli GMs 1895-1911 (Boulder)
			Hannan's Croesus GMg 1897 (Kalg)
			North Croesus GM 1897 (Kalg).
<b>D</b>		<b>F</b>	
Daggar, H.J.	Associated GMs (WA) 1906-08 (Boulder)	Fairfull, A.	Hope's Hill GM '04 (Hope's Hill, Yilgarn)
Dalgleish, G.	Cumberland GM 1906 (Norseman)	Falconer, R.	Lady Shenton GM '04-05 (Menzies)
Daly, H.J.	Hampton GMg Areas 1920 (Coolg)	Faul, A.E.	S. Kalgurli (Con) 1912-15 (Boulder)
Daniell, W.L.	W. Australian GFs 1901 (Cue)	Faul, W.G.	Lancefield GMg 1917-20 (Laverton)
Davey, C.	Whim Well Cpr Ms 1916-17 (WPGF)	Fell, W.B.P.	Westralia & E.Extn Ms '08-10 (Coolg)
Davies, J.	Queen Margaret GMg 1904-08 (Bulong)	Fenton, T.F.	Light of Asia Amalg GMs 1897 (Cue)
Davies, R.	Marmont GMg Syn 1914-17 (Day Dawn)	Ferguson, M.	Golden Pole GMs '02-04 (Davyhurst)
Davies, W.A.T.	Queen Margaret GMg 1905-07 (Bulong)	Field, G.H.	Queensland Menzies 1904 (NCGF)
Davis, A.	Emerald Reward GM 1897 (Yalgoo)	Fimister, J.W.'	Oroya Links 1917 (Boulder-Kalg)
Davis, J.J.	Sons of Gwalia 1904 (Leonora)	Fitzpatrick, T.	Sons of Gwalia S.GM '06-11 (Leonora)
De Stoutz, E.	King Solomon's GMs 1902 (Coolg)	Flach, C.	Golden Pole GMs 1911 (Davyhurst)
Deverell, F.	Lndn&Coolg Expl '03-04 (Kanowna)	Forbes, D.G.	Prcess Royal S.GM 1906 (Norseman)
Dick, A.H.	Riverina S. GM 1916 (Mulline)	Forrest, G.E.	Donnybrook GFs 1902-04 (SWMF)
Dick, J.M.	Nickel-Kramer Tin Mg 1907 (GMF)	Fraser, E.B.	Hannan's N. GMg 1901-02 (Kalg)
Dickinson, A.	Thorniley Exploration 1894-95	Freeman, G.J.	North Star GMs 1902 (Malcolm)
Ditchburn, R.W.	Childe Harold 1918-20 (Euro)	Furze, J.	G Expln & Devel Co (WA) 1897
	Mary Mac GM 1920 (Laverton)		Menzies Consd GMs 1905 (NCGF)
Dow, J.	Gn Horse-shoe Est '17-23 (Boulder)		Assoc N. Blocks (WA) '12-17 (Boulder)
Downing, H.P.	Peak Hill GF 1910 (PHGF)	<b>G</b>	
Dowrick, J.A.	Sons of Gwalia 1911 (Leonora)	Galloway, J.M.	Birthday Amalg of WA 1897
Drummond, A.	Assoc N. Blocks 1912-20 (Boulder)	Garden, C.A.	Robinson GMs (WA) '03-05 (Kanowna)
Drysdale, W.	Collie Co-op (Coal) Co 1910 (CRMF)		Lake View S. GM (WA) 1906-07 (Boulder)
Duncan, W.	Gn Treasure GM 1907 (Kookynie)		Lancefield GMg 1908-13 (Laverton)
	Queensland Menzies GM 1907-08	Gardiner, W.R.	Assoc GMs of WA 1911 (Boulder)
Dunsford, G.B.	Col Con Fin Corp '01-08 (Lennonville)	Garnett, F.Y.	Fraser's S. Extd 1901 (Southern Cross))
Dunstan, J.J.	Assoc GMs (WA) 1903-06 (Boulder)	Gaston, H.	Westralia Mt Morgans '96-99 (Mt Morgans)
	Homeward Bnd GM '10 (Davyhurst)	Giblin, N.E.	Golden Ridge GM 1909 (Boorara)
Durant, P.	Gwalia Con 1907-08, '14 (Wiluna)	Edna May Cen GM	1917-20 (Westonia)
`	North Star GMs 1902 (Malcolm)	Gibson, R.	Lady Evelyn GMs '99 (Cashmans BAGF)
<b>E</b>		Gifford, G.G.	Coolgardie Central 1897 (CGF)
Eades, R.	Block 45 (ECGF) 1896 (Kalg)	Gilbert, C.	Maori Queen GM '03-05 (Ravensthorpe)
East, J.	Whl of Fortune S. M '01 (Lennonville)	Gilbert, M.	Assoc Mt Jackson GM '01 (Mt Jackson)
Eastwood, J.N.	Golden Pole GMs '10-11 (Davyhurst)	Gilbert, S.J.	Great Fingall Con 1911-13 (Day Dawn)
	Sons of Gwalia S.GMs '11 (Leonora)		Sons of Gwalia 1916-20 (Leonora)
Edgar, H.S.	Havilah GM 1907 (Black Range)	Gill, G.	Cosmopolitan Pty 1905 (Kookynie)
	Gn Treasure GM 1908 (Barrambie)		
Elferson, W.	Croesus S. GMs 1900 (Kalg)		
Ellis, E.	Water Trst, Mng & Pblic Crshg 1897		

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Glockner, L.	Cosmopolitan Pty 1904 (Kookynie)	Hills, C.R.	Northern Mines 1907-12 (Lawlers)
Goninon, R.	Menzies Con 1903-25 (NCGF)	Hobby, W.H.	Field's Rwd GM '03-04 (Fields Find)
Goodall, T.C.	Assoc GMs of WA 1904 (Boulder)	Hochschild, M.	Phillips R G&Cp '09-13 (Mt Desmond)
Goodwin, C.	Great Fingall Con 1898-99 (Day Dawn)	Hochschild, S.	Mt Cattlen Cp Mg '09 (Ravensthorpe)
Govett, G.	Menzies Con 1918-20 (NCGF)		Phillips R G&Cp '09 (Mt Desmond)
Grace, C.J.	Great Fingall Assoc 1905 (Day Dawn)	Hocking, S.E.	Black Hill Devel 1910-11 (MGF)
Graham, A.	Chaffer's GMg 1911-12 (Boulder)		Morning Star GMs 1912-14 (MGF)
Grant, C.	Flag G & Cpr Mg '07-11 (Kundip PRGF)	Hocking, W.	Hannan's Rwd 1894-01 (Kalg)
Grant, R.J.	Cosmopolitan Pty 1904-05 (Kookynie)		Ivanhoe Jctn GM 1906-08 (Boulder)
Gregory, E.H.	Half-Mile Reefs Ms 1901-05 (Bardoc)	Hodgson, A.A.	Fenian GM Syn 1916-26 (Cue)
Griffiths, E.	Assoc N. Blocks 1918-20 (Boulder)	Hoffman, E.A.	Oversight Leases 1909 (Norseman)
Gruss, J.	Great Fingall Reefs 1896-97 (Day Dawn)	Hogg, G.	Fraser's GM 1904 (Southern Cross)
		Homersham, E.C.	
Gunton, G.	Edna May Battler GM 1920 (Westonia)	Hopking, H.W.	Sons of Gwalia 1899 (Leonora)
Guthrie, W.M.	Lancefield GMg 1908-13 (Laverton)	Hoskin, W.	Barrambie Rng GM '08-09 (Black Rng)
		Howard, E.	Cue GMg & Expln 1902-03 (Cue)
<b>H</b>		Howe, B.	Ivanhoe S.Extd GM Est '02 (Boulder)
Hack, W.	WA Murchison Prosp Syn 1896	Hudson, W.T.	Gwalia Con 1912-13 (Wiluna)
Hackett, J.	Craiggiemore Pty '03-04 (Laverton)	Huntley, R.E.	Grt Bldr Persev 1909 (Boulder)
Haig, J.M.	Gn Link Con GM 1898-1909 (Kalg)		Croesus S. GM 1907 (Kalg)
Hall, R.B.	Ivanhoe Gold Corp 1905 (Boulder)		
Hall, R.W.	Assoc N. Blocks (WA) 1907-11 (Boulder)	<b>I</b>	
Hall, W.T.	Gwalia Consd 1906-07 (Wiluna)	Irwin, W.A.	Hannan's Oroya GMg '96-8 (Boulder)
Halliwell, L.V.	Lake View & Star 1914-20 (Boulder)		Assoc GMs of WA 1899 (Boulder)
Hambly, W.T.	Broad Arrow GM 1896 (BAGF)	<b>J</b>	
Hancey, F.	Qn Margaret S. GM 1896-00 (Bulong)	Jack, E.F.	Golden Ridge GM '09-16 (Boorara)
Hancock, A.L.	Ivanhoe GMg 1897 (Boulder)		Nw Boddington GM Syn '17 (G'ngarrie)
Hancock, H.L.	Golden Zone GM 1897-05 (Kalg)	Jackson, W.R.	Marmont GMg Syn '09-16 (Day Dawn)
	Hannan's Find G Reefs 1907 (Kalg)		Black Rng Pinnacles '16 (Sandstone)
Hannah, J.G.	Northern Mines 1908-10 (Lawlers)	Jacobs, A.E.	Grt Bldr Persev GM 1910-18 (Boulder)
Hardy, T.	Hannan's Britannia GM 1900 (Kalg)	James, R.	Edna May Battler GM '16 (Westonia)
Harms, H.A.	Gwalia Central 1919-25 (Leonora)	Jamieson, A.E.	Oroya Black Rng '12-13 (Sandstone)
Harrington, J.C.	Ironsides N. GM 1903-04 (Kalg)		Yuanmi GMs 1914 (Youanmi)
Harris, J.H.	Qn Margaret Cen M '99-00 (Bulong)	Jardine, J.	Qn Margaret GMg 1908 (Bulong)
Harris, J.W.	Grt Bldr Pty 1903-06 (Boulder)	Jewell, R.	Great Fingall Con '10-13 (Day Dawn)
Harris, S.	Hannan's Rwd GMg 1895-0 (Kalg)	Johns, W.W.	Brown Hill Extd 1895-1907 (Kalg)
Harris, T.H.	Fraser's S.Extd '05 (Southern Cross)	Johnson, F.D.	Ivanhoe Jctn GM 1902-04 (Boulder)
Hartrick, J.S.	Empress GM 1915-18 (MGF)	Joice, G.	Lancefield GMg 1912 (Laverton)
Hatton, F.	Great Fingall Con '16-18 (Day Dawn)	Jones, G.	Lancefield GMg 1904 (Laverton)
Hay, J.M.	Golden Links 1902-08 (Kalg)		
Head, B.	Orion Ms 1915 (Niagara)	<b>K</b>	
Hewitt, W.	Edna May Dp Lvl's '19-20 (Westonia)	Kane, E.T.	Sons of Gwalia 1904 (Leonora)
Heydon, W.J.	Cue One M 1902-14 (Cue)	Kay, B.	Lake View Consols 1902-03 (Boulder)
	Victory United GM '05 (Cuddingwarra)		London & WA Expln 1903-04 (Lawlers)
	Big Bell GM 1915 (Cuddingwarra)	Kearnan, J.	Grt Bldr Persev 1896-97 (Boulder)
Hill, A.W.	Oroya Black Rng '08-11 (Sandstone)	Kerss, R.	Sons of Erin GM 1906-07 (Higginsville)
Hill, W.C.	Murrin Pty Extd 1905-10 (Murrin)	Kilkenny, J.	Westralian Gully Tin 1903-08 (GMF)
	Hills Pty 1912-13 (Murrin)		

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King, A.T.	Great Fingall Con 1910-11 (Day Dawn)	Montgomery, W.	Corinthian N.GM '14-16 (Corinthian)
Knutsen, H.	Lndn &Hamburg G Rcv '14-16 (Kalg-Bldr)	Montgomery, W.	Bullfinch Pty'17-20 (Bullfinch Yilgn)
Kofoed, H.R.	Havilah GM 1907-12 (Black Range)	Moody, C.J.	Lake Vw Consols 1904-07 (Boulder)
<b>L</b>		Moore, J.	Sons of Gwalia 1902-03 (Leonora)
Laidler, H.J.	Ivanhoe G Corp 1910-12 (Boulder)	Moore, L.T.	Bayleys Con GM 1905 (Coolg)
Lang, J.H.	Edna May GM 1918-20 (Westonia)	Morgan, A.C.	Ivanhoe S. Extd 1905-07 (Boulder)
Larcombe, C.G.	WASM staff 1907-34	Morley, W.	Gn Horse-shoe Est '09-20 (Bouldr)
Lawn, R.	Edna May GM 1918-20 (Westonia)	Morton, H.F.	Hainault GM 1909 (Boulder)
Leahy, A.	Riverina S. GM 1920 (Mulline NCGF)	Munro, W.E.	New Orient GMg '02 (Lake Austin)
	Assoc N. Blocks GM 1910 (Boulder)	Munro, W.M.	Assoc GMs of WA '18-20 (Boulder)
Leahy, F.T.	Marvel Loch GM 1913 (YIGF)	<b>Mc/ Mac</b>	
	Mountain Queen 1911-12 (YIGF)	McAuliffe, J.	Oroya Links '11-13 (Boulder-Kalg)
Leech, G.W.	Paringa Ms 1902 (Boulder-Kalg)	McCulloch, J.	Ivanhoe G Corp '12-20 (Boulder)
Leevers, W.T.	Grt Bldr Persev 1910-21 (Boulder)	McDermott, W.	Gwalia Con 1910-12 (Wiluna)
Leggett, W.	Lake View & Star 1919-20 (Boulder)	McDougall, D.	WASM staff 1906-31
Leggo, A.V.	Transvaal M '19-20 (Greenmount Yilgn)	McFarlane, G.	New Standard Expln 1903-04
Lesley, W.	Peak Hill GF 1902 (PHGF)	McGee, H.L.	Grt Fingall Con '14-15 (Day Dawn)
Lindsay, J.	Estano Sluicing 1913-18 (GMF)	McIntyre, J.	Lily GM 1910 (Niagara)
Lisle, R.	N. Boulder GM 1901-02 (Boulder)	McKay, J.H.	New Murch King GM '02 (Abbotts)
Lloyd, E.A.	Gn Valley Ms of WA 1900 (Kanowna)	McKensie, D.	S. Kal Con 1920-34 (Boulder)
Lloyd, E.L.	Light of Asia 1903-13 (Cue)	McLeod, J.A.	Mararoa GM 1914 (Norseman)
Lugg, R.B.	S. Kalgurli Con 1917 (Boulder)	<b>N</b>	
Lynch, H.Y.	Grt Fingall Con 1904 (Day Dawn)	Nardin, E.W.	Hannan's Star 1904 (Boulder)
Lyon, G.	Bailey's Reward 1895 (Coolg)	Newman, E.B.	Bullfinch Pty '20 (Bullfinch, Yilgarn)
Lyon, H.	Turn of Tide Dev Syn '03-05 (Reedy's)	Newman, J.M.	Peak Hill GF 1908 (PHGF)
<b>M</b>		Nicholson, L.E.	Oroya Brownhill '03-06 (Bldr-Kalg)
Mack, A.C.	Oroya Black Range 1908 (Sandstone)	Norris, W.J.	Oroya Brownhill '10-12 (Bldr-Kalg)
Maitland, C.	Zoroastrian G Est '01-03 (Bardoc BAGF)	Northey, A.E.	Lancefield GMg 1909 (Laverton)
Margetts, F.H.	Assoc N. Blocks 1917-18 (Boulder)	Nutman, H.	Mt Charlotte M 1898-1902 (Kalg)
Marmion, W.R.	Golden Ridge GM 1918 (Boorara)	<b>O</b>	
Martin, A.B.	Golconda GM 1902-05 (Lake Austin)	Oldfield, H.	Mount Ida GM '20 (Mt Ida, Menzies)
Mathea, C.F.	Mikado GM 1907-13 (Burtville)	Opie, W.T.	Bayley's GMs 1901-02, 1905-07
Matthews, E.	Hannan's Kal Pty 1901-04 (Kalg)	Osborne, G.W.	Yuanmi 1913 (Youanmi)
Matthews, P.	Black Range W. GM 1916-8 (Sandstone)	Overman, B.	Ida H GM 1913 (Laverton)
Black Range Con Ms 1919 (Sandstone)		<b>P</b>	
Mathiessen, E.	New Moon (Norseman) 1910 (DGF)	Palfreyman	
Maxwell, J.	Donnybrook GF 1905 (SWMF)	A.W.	Field's Rwd GM '04 (Fields Find)
Meagher, D.T.	Gn Pike&Lake Vw E. Ms '01-07 (Boulder)	Park, W.J.	Sns of Gwalia S.GMs '11 (Leonora)
Meatcham, L.S.	Black Range Con Ms 1920 (Sandstone)	Parker, E.	Credo GM 1897 (Broad Arrow)
<b>M</b>		<b>P</b>	
Meecham, B.	Moonlight GM 1920 (Wiluna)	Parramore, R.H.	Zoroastrian G Est '99 (Bardoc)
Merrit, F.B.	Lake Way GM 1914 (Wiluna)	Paterson, R.B.	Commodore GM '14-17 (M'katharra)
Merry, H.F.D.	Victory Untd GM '07-12 (Cuddingwarra)		Cen&N.Bldr GM '02-03,07-08(Bldr)
Messenger, L.S.	S. Kal Con 1920 (ECGF)		
Miller, G.	Oroya Brownhill 1910 (Boulder-Kalg)		
Miller, J.	Gwalia Con 1910-11 (Wiluna)		

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Penberthy, A.	Cue Victory GMs 1903-05 (Cue)	Saunders, H.M.	Mt Jackson GMs '05-07 (Mt Jackson Yilg)
Penberthy, J.	Emerald Reward 1895 (Yalgoo)	Schellenberger H.	Grt Bldr Pty 1917 (Boulder)
Perry, B.	Field's Rwd GM '06 (Fields Find)	Scott, C.W.	Leviathan GM 1903-04 (Cue)
Perry, W.	West Aus Cpr Ms 1916-17(WPGF)	Scrubby, H.M.	Oroya Black Range 1906-12 (Sandstone)
Phillips, J.	Kalgurli GMs 1914-15 (Boulder)	Scrymgfour, W.	Ingliston Extd 1916-17 (Meekatharra)
Phillipson, W.B.	Victory Untd GM 1903-04 (Binduli)	Seymour, A.P.	Fraser's GM 1904 (Southern Cross)
Pitlado, L.	Whim Well Cpr Ms 1916-17(WPGF)	Seymour, G.	Craiggiemore Pty 1907-08 (Laverton)
Pollard, E.	WA Smelting 1898 (Fremantle)	Sharp, T.P.	WA Venture Syn 1897 (Cue)
Pooley, J.	North Kalgurli 1907(Kalg-Boulder)	Sharpe, R.A.	Fremantle Tradg 1917-20 (NMF)
Porter, A.	Grt Fingall Assoc GM 1905 (Day Dawn)	Shaw, E.W.	Grt Fingall Con 1913 (Day Dawn)
Porter, T.	Lancefield GMg 1920 (Laverton)	Sheard, A.	Oroya Links 1912-18 (Boulder-Kalg)
Potter, J.M.	Hannan's Reward N.GM 1901-2 (Kalg)		Grt Fingall Con 1902-03 (Day Dawn)
Powell, R.W.	Augusta GM 1915 (Laverton)		Long Reef GMg 1903 (Lennonville)
Prescott, J.V.	Londonderry GM '96-01 (Londonderry)	Sheridan, R.	Lond & WA Expln 1904-05 (Lawlers)
Preston, E.T.	Hill End M 1902 (Jasper Hill, Day Dawn)	Shoch, E.R.	Menzies Untd Ms 1896-97 (Menzies)
Purchas, G.H.	Assoc GMs (WA) 1909 (Boulder)	Simpson, G.	Childe Harold GM 1902-03 (Laverton)
	Bayley's Consols GM 1903-04 (Coolg)	Sinclair, D.D.	Gwalia Con 1909 (Wiluna)
			Hannan's Reward 1904, 1909-11
<b>Q R</b>			N. Kalgurli '08-09 (Kalg-Boulder)
Reardon, E.H.	Hampton Plns Est (1906) 1908 (Coolg)	Sinclair, W.A.	Londonderry GM '03-05 (Coolg)
Richards, E.	Riverina S. GM 1917 (Mulline, NCGF)	Skewes, E.	Grt Bldr Main Reef '98-99 (Boulder)
Richards, F.C.	Phillips R G & Cpr '09 (Mt Desmond)	Skrine, C.N.	Amalg GMs of WA '01-02 (Boulder)
Richards, G.	Cen & W. Boulder GM 1917-20 (Boulder)		Gn Arrow M '03-07 (Broad Arrow)
Richardson R.J.D.	Gn Ridge GM 1907-11 (Boorara)		Clarmont GM '08-10 (Broad Arrow)
Rickard, W.J.	Empress GM 1917-18 (Lennonville)	Skuthorpe, G.S.	Bullfinch Pty '00 (Bullfinch Ylgn)
Roberts, A.L.	Ingliston Con Extd '13-25 (Meekatharra)	Smith, A.G.	Mt Magnet Gn Crn '97(Mt Magnet)
Roberts, C.M.	Ingliston Con Extd '10-19 (Meekatharra)	Smorfitt, C.	Grt Bldr Pty 1905 (Boulder)
Robertson, T.	Black Range Mg '09-15 (Sandstone)	Spicer, H.N.	Childe Harold GM '03-4 (Laverton)
Robinson, J.C.	Nannine GM (Pty) 1903 (Nannine)	Stanfield, H.	Grt Fingall Con '02-03 (Day Dawn)
Robson, G.	Hannan's Star GMs 1900 (Boulder)	Stephenson, G.E.	West Fingall 1902-03 (Day Dawn)
Rosman, E.C.	Ivanhoe G Corp '07-10,'13-20 (Boulder)		Grt Fingall Con 1915 (Day Dawn)
Rosman, E.H.	Grt Bldr Pty 1909-10 (Boulder)	Stockdale, J.H.	Birthday Gift GM '12-13 (Burtville)
Rowbottom, A.	S. Kalgurli Con 1916 (Boulder)	Stokes, C.E.	Westralia & E.Exn Ms '02-04(Linden)
Rowe, F.T.	N. Kalgurli GM 1904 (Kalg-Boulder)	Stokes, J.M.	Lancefield GMg '03-05 (Laverton)
Rowe, H.E.	Black Range Mg '09-15 (Sandstone)	Stopher, R.H.	Murch Assoc GMs '08-10 (Cue)
	Black Range Pinnacles '16 (Sandstone)		E. Fingall GMs 1909 (Day Dawn)
Rumble, E.W.	Princess Royal N. GM 1906 (Norseman)	Strachan, M.	Oroya Brownhill '05 (Kalg-Boulder)
Rutherford, J.	Hainault GM 1895 (Boulder)	Strauss, C.F.	Lancefield GMg '02-03 (Laverton)
Ryan, P.J.	Wheel of Fortune N. 1904 (Lennonville)	Swanson, F.	Kalgurli GMs 1912 (Boulder)
	Long Reef 1904 (Lennonville)		
<b>S</b>		<b>T U V</b>	
Saint Anstell	Yerilla Claims 1896-97 (Yerilla NCGF)	Taylor, A.	Mt Jackson GMs '04 (Mt Jackson)
Salmon, A.	Kaloorlie Amalg 1903-08 (Kalg)	Taylor, C.	N.W Assoc GMs 1903 (Boulder)
Sanderson, A.	Barrambie Rng GM '08-09 (Black Range)	Taylor, R.H.	N. Gn Crown 1904 (Kanowna)
Sanderson, F.R.	Barrambie Rng GM '07-08 (Black Rng)	Taylor, T.	Grt Bldr Pers 1906-08 (Boulder)
Sargent, H.L.	Gn Age Con 1901-03 (Wiluna)	Teede, S.A.	EdnaMay Btlr GM'17-18 (Westonia)
			Grt Bldr Pty 1913-20 (Boulder)



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Teede, S.A.	Grt Bldr No.1 1910-16 (Boulder)	Williamson, R.B.	Bullfinch Pty '17-19 (Bullfinch Ylgn)
Thomas, F.L.	Premier GMs '03-07 (Kunanalling)	Wilson, H.	Kalg Mint & Iron King 1897 (Boulder)
	Mountain Queen 1912-14 (YIGF)	Wilson, W.R.	Octagon Explrs 1897 (Leonora)
Thomson, C.	Wealth of Nations '97 (Dunnsville)	Wood, F.S.	Kalgurli GMs 1903-17 (Boulder)
Till, R.G.	Cumberland GM '99 (Norseman)	Woolcock, J.G.	Princess Royal GM '06 (Norseman)
Tinney, W.H.	G Explorers 1896	Wright, G.M.	Gladsome GM Syn '14-20 (Meekatharra)
Tipping, F.H.	Aus Mg & G Recovery 1909	Wright, H.E.	Bellevue 1911 (Sir Samuel)
Tobias, E.R.	King Solomon's GMs '02-4(Coolg)		
Tom, I.	Assoc GMs of WA 1909 (Boulder)	<b>Y Z</b>	
Tomlinson, H.	Sons of Gwalia 1902 (Leonora)	Yeo, S.J.	Maritana GM 1901-10 (Kalg)
	Grt Fingall Con 1904-11 (Day Dawn)		Sons of Gwalia S.GM '10-12 (Leonora)
Treloar, W.	Prccs Royal GMg '02-09 (Norseman)	Young, G.W.	Lancefield GMg 1909 (Laverton)
Truscott, C.H.	Trafalgar GM 1906 (Kennyville Ylgn)		
Turnbull, G.	Sons of Gwalia 1925-30 (Leonora)		
Turner, W.J.	Ingliston Extd GM '13-17(M'katharra)		
Turner, W.M.	Sons of Gwalia 1910-13 (Leonora)		
Vale, W.H.	Marvel Loch GM '09-11(Marvel Lch)		
Vautin, H.D.	Bellevue 1908-10 (Sir Samuel)		
	Northern Ms 1910-12 (Lawlers)		
Vivian, W.M.	Bayley's No.2 S. GMg (Coolg) 1897		
Von Arnheim, C.T.	Golden Pole GMs '10 (Davyhurst)		
	Sns of Gwalia S.GM '10-11(Leonora)		
<b>W X</b>			
Waite, E.M.	Oroya Links '14-16 (Kalg-Boulder)		
Walker, C.E.	Grt Bldr Pty 1920-25 (Boulder)		
Walker, J.S.D.	Gn Ridge GM '12-14 (Boorara)		
	Ingliston Extd 1915 (Meekatharra)		
Warman, J.	Sons of Gwalia 1902-03 (Leonora)		
Warrell, J.	Trafalgar GMs 1901-02 (Kennyville)		
Warren, J.B.	Menzies Con GMs '01-05 (Menzies)		
Watkinson, E.	N. Kalgurli 1906-07 (Kalg-Boulder)		
	Zoroastrian 1906-07 (Bardoc BAGF)		
Wearmouth, R.	Burbanks Mn Lode GM '04 (Burbanks)		
Webb, G.	Slug Hill GMg 1897 (Boulder)		
Wells, R.N.	Lovely & Wells 1895 (Coolgardie)		
Welsh, D.W.	Ida H GMg 1911-12 (Laverton)		
West, C.O.	Hannan's Pride GM 1897 (Kalg)		
	Hannan's Croesus GMg '97-00 (Kalg)		
Whitford, T.F.	N. Boulder GMg 1895 (Boulder)		
Williams, R.	Brd Arrow Con GM '04-08 (Brd Arrow)		
	Edna May Cen GM '15-16 (Westonia)		
Edna May Battler	GM '19 (Westonia)		
Williams, W.	Gn Ring (WA) Pty 1896-98 (MMGF)		
Williams, W.E.	Lake View Consols 1909-10 (Boulder)		
	Grt Fingall Con 1911 (Day Dawn)		
	Lake View & Star 1912-18 (Boulder)		

## APPENDIX A

### OTHER MINE MANAGERS AND MINING TECHNOLOGISTS with known mining employment in Western Australia 1890-1920

#### Abbreviations used in Appendix for company names

Amalg	Amalgamated	M	Mine
Assoc	Associated	Mg	Mining
Bldr	Boulder	Mn	Main
Bnd	Bound	Ms	Mines
Btlr	Battler	N.	North(ern)
Cen	Central	NE	North-eastern
Cnsols	Consols	NW	North-western
Co	Company	Pers	Perseverance
Col	Colonial	Plns	Plains
Con	Consolidated	Prcess	Princess
Coolg	Coolgardie	Pty	Proprietary
Cp	Copper	Pub	Public
Crn	Crown	R	River
Crshg	Crushing	Rcv	Recovery
Devel	Development	Rf	Reef(s)
Dp	Deep	Rng	Range(s)
E.	East(ern)	Rwd	Reward
Est	Estate(s)	S.	South(ern)
Expln	Exploration	Str	Star
Explr	Explorer(s)	Syn	Syndicat
Extd	Extended	Tmnt	Treatment
Extn	Extension	Trdg	Trading
Fd	Find	Trst	Trust
Fin	Finance	Untd	United
G	Gold	Vw	View
GF	Goldfield	W.	West(ern)
GM	Gold mine	WA	Western Australia(n)
GMg	Gold Mining	WASM	WA School of Mines
GMS	Gold Mines	Whl	Wheel
Gn	Golden		
Grt	Great		
H	Hill		
Jctn	Junction		
Kal	Kalgoorlie		
Lse	Lease(s)		
Lvls	Levels		
Lndn	London		

## APPENDIX A

### OTHER MINE MANAGERS AND MINING TECHNOLOGISTS with known mining employment in Western Australia 1890-1920

#### ADDENDUM

Barnes, C.H.	Kalgurli GMs 1901-03 (Boulder)
Bawden, W.R.	Hannan's Star GMs 1900-06 (Bldr)
Bell, F.L.	Commodore GM 1918-19 (Meeka)
	New Commodore GM 1920 (Meeka)
Black, R.A.W.	Black, Blatchford & Grut '06-11 (Kalg)
Brown, J.W.	Childe Harold GM 1902-03 (Euro)
	Hannan's G Ests '03-04 (Kookynie)
Buckley, H.	S. Kalgurli GMs 1903 (Boulder)
Dick, W.	Gn Horseshoe Est 1897-99 (Boulder)
Ditchburn, G.L.A.	Ivanhoe G Corp 1917 (Boulder)
Hissert, F.A.	London & WA Expln 1897 (Coolg)
Homersham, E.C.	Sons of Gwalia 1899 (Leonora)
Jones, W.S.	Merton's Rewd '07-08 (Mertondale)
	Augusta GM 1913 (Laverton)
Kewney, A.V.	Paringa Ms 1908 (Kalg-Bldr)
	Orion Mines 1910-13 (Niagara)
	N.White Feather '09,'14-17 (Knwna)
King, E.S.	Oroya Brownhill 1907 (Kalg-Bldr)
	Gwalia Con 1910 (Wiluna)
Martin, C.	Westralia Mt Morgans 1906-10
Mumford, F.T.	S. Kalgurli 1900-01 (Bldr)
O'Neil, D.	Lake View & Bldr E 1895-96 (Bldr)
	Brookman Bros Bldr 1896-01 (Bldr)
Opie, W.T.	Bayley's Ms 1896-01 (Boulder)
Williams, M.T.	Edna May GM 1916-20 (Westonia)
Wright, H.B.	Grt Bldr Perseverance '03-18 (Bldr)

## APPENDIX B

### Innovations in gold metallurgy and processing technology in Western Australia 1890-1920

July 1896	First successful use of Sulman & Teede's bromocyanide process at Day Dawn (Cue)
1896	First use of filter presses in processing of Kalgoorlie ore in Hamburg, Germany (Hannan's Brownhill)
1897	First use of filter presses in Kalgoorlie : April; Johnson press at Brownhill's rebuilt first oxidised mill August; Deyne press at Lake View Consols oxidised mill December; Deyne press at Brownhill's second oxidised mill
Dec 1897	First use of bromocyanide in Kalgoorlie for treating oxidised ore at Brownhill's second mill
1898	Askin Nicholas at Peak Hill successfully uses first vacuum filter for cyaniding slimes in form of continuously operated movable drum filter (anticipates Oliver drum filter of 1907)
1898-99	Koneman contracted to build complete sulphide mill for Great Boulder. His shaft furnace, requiring only crushing to 'hazel nut' size, roasted 'perfectly' with major savings but a later stage failed and the whole process had to be abandoned.
1899	First successful 'dry crush, roast and sliming' process by Marriner at Great Boulder Main Reef which becomes Kalgoorlie dry crushing standard for sulphide processing
1899	Marriner uses Wheeler pans at GB Main Reef principally for fine grinding of sands to slimes as well as for amalgamation and overflow of soluble sulphates
Jan 1900	First demonstration of Diehl process for sulphide processing at Lake View Consols
Jan 1900	First use of tube mills for fine crushing at Diehl process demonstration at Lake View Consols
March 1900	First commercial use of the Diehl process at Hannan's Star
1901-03	Only smelter on Golden Mile processes sulpho-telluride ore at Golden Horse-shoe (Sutherland & Klug)
1903	Elmore oil flotation process trialed at Lake View Consols
Nov 1903	Second smelter built at Fremantle by Klug with 'barrel' Bessemer converter (first in state)
1906	Ridgway's Mk 1 vacuum filter installed at Great Boulder. Radical design with 99% gold recovery and cheapest to operate (1/3 cost of filter-pressing)
1911	Ridgway's Mk 2 vacuum filter installed at Great Boulder. Larger capacity, cheapest to operate but gold recovery only 70%
Nov 1912	Degenhardt & Jordan at Youanmi built first downdraft gas producer generating gas directly from mulga wood instead of via charcoal, nearly halving cost of power to mine
1913	Moore & Edmands at Youanmi introduce Moore-Edmands extractor as alternative method of precipitation using zinc dust & modified vacuum filter (anticipating post-war Merrill-Crowe precipitator)
1914	Edquist at Great Fingall first in WA to use continuous counter-current decantation (process water fully recycled)
1916	Edmands at Youanmi substituted pulverised charcoal for zinc dust in Moore-Edmands extractor, increasing gold recovery rate from 92.8 to 98.7% (anticipates carbon in pulp process)

## WESTRALIAN FOUNDERS OF 20<sup>TH</sup> CENTURY MINING

This book outlines the careers of a whole generation of mining engineers, mine managers and other mining technologists who worked in Western Australia during its Golden Age from 1890 to 1920. It was a remarkable generation which made Kalgoorlie-Boulder one of the great mining centres of the world and in the process, during the 1900s, made it the world leader in gold metallurgical innovation. The book which is based on extensive bibliographic research outlines over three hundred careers and, of these, extended biographies are provided for twenty of the outstanding leaders of the industry and a further thirty also have lengthened entries. In addition the book tabulates the mines at which a further 439 managers and technologists worked during the same period. Not only does it provide essential background to important technological changes but the book could also prove useful for many local historians and family researchers.